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# USSR Report

ENERGY

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28 March 1986

## USSR REPORT

### ENERGY

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OIL AND GAS

NEW, BELATED DECISIONS IN DEEP DRILLING TECHNOLOGY

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 6 Sep 85 p 2

[Article by the Scientific and Technical Progress Department of SOTSIALISTICHESKAYA INDUSTRIYA: "Followup: A Turbodrill in the Clutches of Red Tape"]

[Text] In order to provide for the exploration of oil and gas reserves and the growth of the level of production, it is necessary to increase sharply the amount of deep drilling. However, as noted at a CPSU Central Committee session on issues in accelerating scientific and technical progress, the possibilities of the equipment and technology currently employed in deep drilling are practically exhausted. Fundamentally new solutions are needed.

The fate of one of these solutions was discussed in the article "A Turbodrill in a Ring of Paper" (SOTSIALISTICHESKAYA INDUSTRIYA of 17 March 1985). It was noted in it that a state commission had recommended the TRM-195 reduction-gear turbodrill for series production as early as 1979. Tests in the difficult geological conditions of West Siberia had shown that the new unit permits an increase of two and a half times in the footage per bit, a 20-percent decrease in the cost of drilling operations and a 15-percent reduction in electricity expenditures. At the same time, drill site down-time due to pump repair is practically eliminated. The turbodrill design makes it possible to withstand well temperatures up to 250 degrees. The Kolskiy super-deep site is indebted to it for production beyond the 12-kilometer mark.

In short, the specialists of the All-Union Scientific Research Institute of Drilling Technology have created a unit that meets the most modern requirements--it is highly productive, economical and reliable. Its innovative principles are protected by the ten copyrights on the invention. Several dozen of these units operate successfully in the most varied regions. But all of them were manufactured... at the institute's experimental base. Minkhimmash [Ministry of Chemical and Petroleum Machine Building], assigned to organize series production of the new turbodrill, has in fact drowned this task in red tape.

The position of Minkhimmash has practically not changed even after the appearance of the newspaper and the subsequent conference at USSR Gosplan. In response to the editorial staff, Deputy Minister of Chemical and Petroleum Machine Building V. Reznichenko reported that the industry plans to produce

60 of the new units this year. But until now, as confirmed by the developers, the ministry has not even started the technological production preparation for their manufacture.

Nor does the further fate of the innovation inspire particular hope. Judging by the response, Minkhimmash has decided to take a position of "principle" if Gosplan allocates the capital investment for a new shop, then there will be a new turbodrill. But even then it will not be till 1990, near the end of the five-year plan. And what do they intend to undertake at the ministry in the meantime? It turns out that "taking into account the complexity of the design, the necessity for its careful machining and the determination of the sphere of economic efficiency of reduction-gear turbodrills, Minkhimmash along with Minnefteprom [Ministry of the Petroleum Industry] will continue their qualifying industrial testing..."

So much for equipment of the highest quality, recommended by state commission for series production!

"What tests?" asked the surprised Deputy Chief of Glavtyumenneftegaz [Tyumen Oil and Gas MA] K. Katin, to whom the editorial staff turned for an explanation. "We've already had about ten TRM-195s in constant operation for seven years. Excellent machines! We use them only for deep drilling, where they are the most efficient: they increase the footage per bit by two and a half times, and lower the cost per meter of well by three rubles. Just multiply that by our drilling volume! Do you see what a saving there is? The sluggishness of Minkhimmash is costing the state dearly. The technical retooling that Glavtyumenneftegaz plans to implement in the 12th Five-Year Plan needs to be carried out using the new turbodrill. For the complex tasks assigned us in 1986 alone, more than a thousand of these bits are needed..."

The staff members of USSR Gosplan hold an analogous opinion:

"The efficiency of the TRM-195 reduction-gear turbodrill is proven, and the areas of application and the requirements of various departments have been made known," answered Yu. Andrianov, the chief of the chemical and petroleum machine building department, to the questions of the editorial staff. "The models manufactured by the institute passed tests in West Siberia, in Bashkiriya, in Tatarsiya, in Azerbaijan and in the Ukraine. And everywhere they have had a sizable economic effect..."

At the USSR Gosplan session after the appearance of the newspaper, Minkhimmash was charged with producing, within a month, a proposal for creating the necessary capacity and organization for series production. But a month passed, and no proposals followed. Only after reminders did the ministry staff members finally present documents in which 35 million rubles were requested. After experts, as they say, apportioned this sum, it became clear that the new shop with all of its equipment needed only... 20 million rubles!

"We feel that the industry has real reserves for organizing the production of the turbodrill before the introduction of new capacity," continued Yu. Andrianov. "Having studied the utilization of several enterprises where



it would be possible to locate TRM-195 production, Gosplan, according to the results of the capacity utilization analysis, included in the Minkhimmash new equipment plan for 1986 the output of one hundred turbodrills..."

So then, a hundred turbodrills. But as already noted, Glavntyumenneftegaz alone will need more than a thousand next year. That is how many Minkhimmash plans to manufacture in 1990. And that on the condition that the new shop is allowed. The West Siberia Oil and Gas Complex will need more than six thousand TRM-195 turbodrills for the five-year plan: without them it is difficult to count on the intensification of deep drilling. Thus are the discrepancies preserved in the future as well.

One might ask: Why did they arise? Are only the staff members of Minkhimmash guilty in this? It seems not. First Deputy Minister of the Petroleum Industry V. Igrevskiy, in response to the editorial staff, acknowledged: "Minnefteprom considers that it did not demonstrate sufficient persistence in accelerating the organization of TRM-195 series production, although their mass incorporation would have allowed a substantial increase in bit operation indices, especially in West Siberia."

The admission, to put it bluntly, is a little late. And it skirts the essence of the matter. If positions in principle will do, then the conclusion must be drawn that the essence is not only "insufficient persistence" with regard to new equipment. The issue is rather a loss of perspective. Otherwise one wouldn't have to speak today of "problem" petroleum and lower the production rate to correspond to the low level of drilling equipment.

12821/12955  
CSO: 1822/135

OIL AND GAS

INCREASED GAS EXTRACTION, PROCESSING IN YAMBURG DISCUSSED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 Oct 85 p 2

[Article by M. Umanskiy, Tyumen: "A Billion!"]

[Excerpt] The collective of the Tyumengazprom [Tyumen Gas Industry] VPO reached the production level of a billion cubic meters of gas a day.

The achievement of this high level ahead of schedule is the result of the harmonious work of gas, construction and transport workers and the workers of related industries. In the current five-year plan, 39 billion cubic meters of the "blue fuel" above the target will be supplied to the national economy. The increase in production will be tens of billions of cubic meters.

"Now the gas industry workers of West Siberia are preparing for the accomplishment of even more large-scale and complex tasks," says R. Vyakhirev, a deputy minister of the gas industry and chief of the Tyumengazprom VPO. "Mingazprom [Ministry of the Gas Industry], along with Minneftegazstroy [Ministry of Oil and Gas Construction] and Minprobor [Ministry of Instrument Building, Automation and Control Systems] and a number of other ministries developed a set of measures aimed at increasing the efficiency of operation of industry enterprises in the region. Special emphasis was placed on the broad application of automation, electronics and microprocessor technology, which will ensure bringing gas production to an even higher level with a significant decrease in labor expenditures. Mikhail Sergeyevich Gorbachev indicated the necessity of precisely such revolutionary steps when he visited Tyumen Oblast."

The first combined gas treatment installation in West Siberia, operating in an automatic mode with enhanced productivity--20 billion cubic meters of gas per year--was placed into industrial operation in Urangoy at the beginning of October. One characteristic of it is that all technological processes are controlled by a microprocessor-based automated system. This ensures the operation of the works with a minimum of service personnel, the high-quality treatment of the raw material and its efficient utilization.

Similar systems are being installed at other Urangoy installations. Their use is envisaged in the more difficult natural conditions of the Far North

and, specifically, at the Yamburg Gas Field. For the first Yamburg installation, which should produce gas next year, twenty of the twenty-five aggregate unit assemblies have been fully equipped. The 250-kilometer Tyumen section of the Yamburg-Yelets gas artery was placed in operation ahead of schedule. Several more sections of the new gas pipeline, with a total length of approximately two hundred kilometers, will be ready for acceptance in the near future.

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## OIL AND GAS

### STRUGGLE TO CONTROL TENGHIZ OIL FIELD BLOWOUT

Moscow IZVESTIYA in Russian 8 Dec 85 p 6

[Article by IZVESTIYA Special Correspondent A. Ryabushev, Guryev Oblast:  
"Taming a Fierce Blowout"]

[Text] The earth burns beneath the feet, and the sand is turning into glass.

"That's enough, it won't do to go any further, it's dangerous!" gestures Vladimir Kukhar, an aide to the platoon commander of the Poltava Militarized Detachment for the Prevention and Elimination of Oil and Gas Blowouts.

My face was pinched with sweat under the breathing apparatus, and it was difficult to breathe due to the high temperature. Tearing out of the ground, the flaming oil gusher roared like dozens of airliners...

On June 24th, here in the Tenghiz Oil Field in the Caspian lowlands, an accident occurred at Exploratory Well No 37 of the Balykshinskoye Exploratory Drilling Administration. Specialists will still have to analyze its causes. In the opinion of the investigative commission, it is still premature to draw definitive conclusions today. The Tenghiz Oil Field is unique in its geological structure, and there are still no analogous situations. The oil is deposited at very great depths here. In certain strata the pressure of the formation is twice as much as usual. Nowhere have the surveyors of petroleum resources had to deal with such as this.

The enormous flame of the blowout shoots up 190 meters over the steppe. The glow of the fire is visible at night from the Caspian Sea for ninety miles. Birds unfortunately sometimes take it for a lighthouse, fly and... perish.

In order to see how the people here operate from the smallest permissible distance, it is necessary to change to a bulldozer. But even in a heat-reflecting suit, it is as hot as an oven here. Bulldozer operator Anatoliy Gerasimenko relates how hard it was to work in the first days, dragging the collapsed drilling rig from the fire. And then leveling the soil at the well-head. The glass of the bulldozer cracked from the high temperature, the paint melted on the cowl, and Anatoliy Gerasimenko's heat-reflecting suit was

smoking. And this even though the heavy machinery was specially protected with heat-resistant metal.

Anatoliy halts the bulldozer. Up ahead in a dug-out pit in an area free from flame is the highest air-temperature zone--two hundred and fifty degrees. But inside the raging fire of the oil well it is 1,500 degrees. Around the wellhead--ninety. This is where the dangerous and heavy work of the blowout workers of the North Caucasus and Ukrainian militarized units for preventing and eliminating oil and gas blowouts takes place. They cannot stay here more than five minutes. But it is not easy to get there either--you have to rush through the area in front of the wellhead in four seconds. Otherwise the heat-reflecting suits can catch fire. Already, about 2,000 silver jackets have had to be sent to the scrap heap because of this. The blowout workers have to do almost all of the operations by hand. Certain operations take weeks. Why? Equipment here is powerless. And the people work...

Specialists from 12 cities of the country participate in eliminating the blowout. They are from three all-union ministries: geology and the oil and gas industries. A special staff was created. It is headed by Valeriy Ivanovich Igrevskiy, first deputy minister of the USSR Ministry of the Petroleum Industry. The oil torch has raged for more than five months over the Kazakh steppe. All this time, the work on its elimination has not abated. Why so long?

"It is so complicated," says Valeriy Ivanovich, "because we cannot eliminate the blowout by the usual method, using water and foam extinguishment. We could have put out the flame in three days that way, but the oil of Tenghiz has the highest concentration of hydrogen sulfide, and the pressure in the formation is more than 850 atmospheres. This is still unknown to world practice. If the flame is put out the way it is normally done by firemen, poisonous gas, not having burned, can poison every living thing for hundreds of kilometers."

It is therefore very difficult to find a way to suppress the flaming blowout. It is, after all, the biggest in the entire history of oil field assimilation. None of the specialists undertook to give specific recommendations. Only Leon Mikhaylovich Kalyna, chief of the Ukrainian militarized unit for the prevention and elimination of oil and gas blowouts, proposed capping the flaming torch with a hydraulic drag and cementing the well under pressure with a chemical solution.

This idea struck many as utopian at a special conference in Moscow at the beginning of August. Many scientists from the major petroleum institutes suggested that to "cork up" the well in this manner is impossible due to its enormous pressure, the absence of specialized equipment for placing the hydraulic drag on the flame and the impossibility of having people working in the high-temperature zone.

One by one the blowout workers of the Groznyy Emergency Militarized Service go out to the wellhead, and they are replaced by people from Volgograd, Poltava and Baku. The exhausted ones return to the dressing room, in burnt heat-reflecting suits.

"The hitch is in order, the configuration can be delivered," reports Kukhar to Igrevskiy and drinks down five bottles of mineral water on the spot. Without pausing for a breath... Yes, it is hot.

Volodya is one of the youngest members of the Poltava Militarized Service. He is 24 years old, but in experience and courage he concedes nothing to such aces as Leon Mikhaylovich Kalyna, Aleksandr Mikhaylovich Novostroyennyy and Volodya Bondarenko. Kukhar has worked with them for three years. "Hot spots" in Afghanistan, Poland, and the Yamal Peninsula are behind him--where he took part in eliminating many insidious oil and gas blowouts. He completed the Petroleum Geological Survey Tekhnikum in Poltava before the army. He recently entered the correspondence school of the Ivano-Frankovsk Oil and Gas Institute. But he did not go to the first orientation session. Learning of the emergency in Tenghiz, he could not abandon his comrades. It was he, Volodya Kukhar, along with Sasha Novostroyennyy, Vitaliy Makarchuk and Volodya Bondarenko, who first laid down the road to the wellhead of the oil torch. They poured red-hot lead in the stuffing boxes of the casing pipe and installed an area for support mechanisms. At critical moments the fellows, if someone's heat-reflecting suit caught fire, protected each other with their own bodies from the fire that was drawing them to itself.

After a few minutes of rest, blowout workers Sasha Novostroyennyy, Volodya Kukhar and Aleksey Volkodav will go out to the wellhead once again. Maybe Aleksey Volkodav is the most nervous--he is the author of plans for the hydraulic drag. It is, after all, namely with the aid of hydraulics that the pressure of the blowout will be restrained. He participated in the development of a mock-up of the capping equipment along with the specialists of the Grozny Mechanical Repair Plant.

The blowout workers go back out to the wellhead once again. The most critical moment has arrived--placing the prototype of the capping equipment on the oil well. Anatoliy Gerasimenko brings the equipment by bulldozer-crane to the railroad that is welded of metal pipes in the wellhead pit. The capping equipment is lowered there and then on wheels along the pipe rails to the wellhead. Blowout workers Sasha Novostroyennyy and Volodya Kukhar begin to install it, joining it to the hydraulic apparatus. An hour passes, and another, a day, two days. The metal pipe of the capping equipment lifts the flame high over the steppe. The flame does not roar on all sides now, it is becoming controllable. The oil tears through the pipe in an almost unified stream of fire.

A way of eliminating the oil torch at Tenghiz has been found. And now it is not necessary to use an industrial explosion to eliminate it, as others had proposed. The courage and heroism of the people, possibly, will allow the avoidance of this extreme plan. The Guryev Machine-Building Plant has begun the manufacture of capping equipment that eliminates the errors and shortcomings of the prototype.

The struggle with the petroleum elements continues...

12821  
CSO: 1822/202

GEOLOGIST ON INCREASED RESERVES, DRILLING COSTS IN PECHORA

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Oct 85 p 2

[Article by M. Volkov, general director of the Pechorageofizika Association, Ukhta: "Technical Progress: The Acceleration of Reserves--The Efficiency of Prospecting"]

[Text] The Timano-Pechora Oil and Gas Province, approximately 400,000 square kilometers in area, already occupies a crucial place in the country's fuel and energy equation. However, the potential opportunities for further increases in oil and gas production here are still far from exhausted. Data received in the current five-year plan have made necessary a radical re-appraisal of the geological conceptions of the location of hydrocarbon deposits in this area. The data refuted the opinion of some geologists on the lack of promise of such regions as the Izhma-Pechora and Khoreyverskaya basins, where oil has been produced in recent years from both new and old deposits.

However, the exceedingly complex geological structure of the province makes prospecting extremely expensive and requires great expenditures of time, especially when drilling deep prospecting and exploratory wells. The possibilities of accelerating and cheapening the geological exploratory process in recent years is ever more affected by the application of a range of geophysical exploratory methods, chiefly seismic exploration.

Taking into account the growing role of geophysical exploratory methods, several major specialized geophysical associations were created in the country. In 1980 such an association was formed in the Timano-Pechora Oil and Gas Province.

The collective of our association fulfilled the intensive tasks and socialist obligations of the five-year plan ahead of schedule. Over this time, more than a hundred new structures were prepared and placed in exploration--more than twice as many as in the last five-year plan. Promising oil and gas deposits were discovered in twenty of them. The reserves of the Kharyaginsk Deposit were confirmed with an excellent rating, to the exploration of which the specialists and workers of the Ukhta Seismic Exploratory Expedition under the leadership of V. Kudryavtsev made a large contribution.

Today, on the threshold of the 12th Five-Year Plan, we reviewed in detail the tasks and problems of further prospecting in the province. The goal was set of not only increasing the volume of prospecting and exploratory operations, but also to accelerate the geological exploratory process overall. Supporting the initiative of the AvtoVAZ Association, the association collective adopted socialist obligations that were increased in comparison with the control numbers of the RSFSR Ministry of Geology. Raising the productivity of labor, increasing the volume of geophysical operations by one and a half times over the five-year plan and further technical and methodological retooling are projected.

The plans, to put it bluntly, are intensive. And this is understandable: the situation today demands genuinely revolutionary changes in geological exploration. The issue is first and foremost the substantial reduction of times for preparing and incorporating into development new deposits with complex structures. And these times are still excessive.

Let us take the cited Kharyaginskoye field. Its structure was already discovered by geophysics in 1964. The first exploratory well was drilled four years later. But the deposit was only discovered in 1977. On the average, ten to fifteen years passed before the discovery of petroleum deposits in such structures as the Baganskaya, Nyadeyyuskaya and others. Such a pace cannot be suitable for us.

It is also impossible to forget that every deep exploratory well in the European North costs 2.5 million rubles--significantly more costly than the average around the country. And so many of them turn out to be non-productive! To solve the problem of economic resources and to gain time is possible only with a radical retooling of our industry. The direct prospecting for hydrocarbons by geophysical methods in a complex with deep parametric drilling can and should produce a revolution in geological exploration for oil and gas.

What is direct prospecting? It is well known that oil and gas collect in the earth's interior in so-called traps at various depths from the earth's surface. Geological exploration determines their locations. But the question of whether there will be raw hydrocarbons in this or that trap is answered today only by a drilled well. Statistics show that only a third of them, as a rule, give a positive result. And knowing in advance if a trap is empty or not can significantly reduce the number of non-productive wells.

In recent years, especially since geophysicists have been equipped with modern equipment, efforts at direct prospecting for oil and gas have been undertaken more frequently. Various modifications of this method have been tested in West and East Siberia, the Volga and Baltic regions, Central Asia, and in our area, in Timano-Pechora Province. A joint scientific and technical council on these problems meets at the USSR Ministry of Geology and a coordinated plan exists for the 11th Five-Year Plan. The first positive results have been achieved. Nevertheless, the scope of application of the progressive method does not inspire optimism.



I will refer to the example of the Pechorageofizika Association. We have created a complete dedicated expedition in the Vorkuta Expedition--a methodological test party whose basic task is the development and incorporation of direct prospecting. But the existing computer centers in Ukhta and Vorkuta do not have sufficient capacity to process the materials received. In 1986 only two computers are planned for the association, which does not solve the problem of computer capacity. Direct prospecting, you see, presupposes an increase of almost six times in the processing volume of field information, and the deeper and fuller utilization of the data received.

Geophysicists today are reminiscent of people who subscribe to newspapers but read nothing but the headlines. And it is hardly due to laziness, but rather due to a lack of the necessary means to process and analyze information. In the current five-year plan it was planned to introduce a powerful PS-3000 specialized processing complex, but its introduction was delayed. The absence of this complex can be temporarily compensated for by a YeS 1061- (1066)-class computer, but we still don't have those either.

At the end of last year we received a new Gorizont computerized multichannel station. And so what? It is still being set up at the industry institute to this day, even though the enterprise spends more than five thousand rubles a month of depreciation allowances. We are allocated funds for another Gorizont this year. Let's hope it doesn't meet the fate of the first one.

It was noted at the October (1985) Plenum of the CPSU Central Committee that a significant advance toward production efficiency is envisaged in the 12th Five-Year Plan. The rapid technical retooling of all geological services, and first of all geophysicists, is a true path toward achieving this aim in industry geological exploration. Expenditures on modern apparatus and computer equipment, as practice has shown, are repaid many times over by speeding things up, lowering costs and raising the quality of operations.

We must speak of yet another urgent problem. During his visit to Tyumen Oblast, M. S. Gorbachev spoke convincingly of the fact that, in assimilating new oil and gas deposits, one should not forget the necessity of taking care of the people. It is impossible to accomplish major economic tasks without this. But today the social problems of field-worker life are no less complex than technical and production ones. In the Pechorageofizika Association, more than 1,200 families need housing, and hundreds of people do not even have dormitories and are assigned to field parties. So as to relieve the stress at least somewhat, we are building ourselves using the organization's own resources. But sometimes these efforts come to naught due to a lack of funds for materials. The housing situation could be improved somewhat by cooperative housing, and many among us wish to participate materially in it. However, even this important source is hardly used in the North.

Naturally, we have our own unutilized reserves. We tried to take them into account in our socialist obligations for the 12th Five-Year Plan.

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OIL AND GAS

LABOR FORCE USE IN WEST SIBERIAN OIL, GAS COMPLEX

Moscow SOTSIALISTICHESKIY TRUD in Russian No 12, Dec 85 pp 17-24

[Article by V. Roik, candidate of economic sciences: "West Siberian Oil and Gas Complex: Utilization of Manpower"]

[Text] An extremely important role in the party's economic strategy is assigned to the opening up and development of the West Siberian Oil and Gas Complex (ZSNGK). To a considerable degree, the pace of its work determines the successes of the entire national economy. This was especially emphasized once again at the conference of the party economic aktiv of Tyumensk and Tomsk oblasts in September 1985.

The development of the ZSNGK is characterized by the large scale and the rapid pace of the performance of the work. Beginning with the 8th Five-Year Plan, dozens of oil and gas deposits have been developed here and a powerful base has been established for the performance of work in geological exploration, the extraction of oil and gas, drilling and construction. All of this made possible the rapid formation of the main fuel and energy base of our country, now providing more than 50 percent of the All-Union production of oil and gas raw materials.

The unprecedented growth rate in extraction capacities under the complex conditions of the north around Tyumensk required bringing in a large amount of manpower from other regions of the country. Over the last two decades, the population of Tyumensk Oblast--in whose territory the main part of the complex is located--doubled, its growth rate there being several times higher than that of the union and republic.

In the 12th Five-Year Plan and in the following years, the complex will face the new tasks of the second, more complicated stage. Many problems have to be resolved. The most important of them are the development of less productive oil deposits, an increase in the share of oil and gas extracted from deep strata, the progressive flooding of operating wells, the increasing dispersion of deposits, and the increasing amount of drilling (up to 90 percent) to support the achieved level of oil production. Also increasing is the unit labor-intensiveness of most of the work as well as the labor-intensiveness of the entire greatly expanded production program. And therefore more builders, drillers, operators and repair workers are required. This tendency is inherent in any extractive sector in any rayon but is especially noticeable

under the conditions of the ZSNGK because of the scale of oil and gas production already achieved. In addition, the work front is moving more and more to the north in all basic sectors of the complex, including in the Polar Regions, and this leads to the necessity of overcoming the influence of worsening mining and geological conditions.

All of this requires the further improvement of the utilization of manpower resources at the enterprises of the corresponding sectors of industry and construction. And it must be noted that much is being done in the region in this direction. The achievements of science and technology are being introduced and the organization of production and labor is being improved at oil and gas production and construction facilities, contributing to the saving of labor input. Thus, deposits are being developed with large-diameter wells in clusters, which made it possible to reduce the number of wells to two-thirds and the length of industrial communications lines by 20 percent. The capacity of constructed block-unit installations for the preparation of gas reached 20 billion cubic meters per year. As a result, it became possible to reduce the time for the construction of industrial facilities to one-third to one-half of the original time and labor expenditures by a factor of 1.7 in construction and by a factor of 1.5 to 2 in operations. The construction of large gas mains with a diameter of 1.42 meters and compressor stations equipped with gas-pumping units having capacities of 16,000 and 25,000 kilowatts in block units greatly reduced the need for operating personnel of the gas-transporting enterprises as well as labor expenditures in construction. Along with this, the laying of main gas lines in a single technological corridor made it possible to reduce the number of workers by 15 to 20 percent.

An important role is assigned to the full mechanization of production processes as the basis for the improvement of management, the increase in the reliability of the work of industrial facilities, and the reduction of the number of service personnel. ASU's [automated control systems] have been established and are functioning for the Tyumengazprom, Nadyngazprom and Tyumentransgaz associations. ASUTP's [plant technical management automation systems] have been put into operation at the Medvezhye and Urengoyskoye deposits and for the gas mains of the Tyumentransgaz Association. Thanks to the automation of installations for the complete preparation of gas and compressor stations, there was a 13 percent reduction in the number of personnel directly involved in the operational management of the processes of the production and transport of gas. To a considerable degree, the application of progressive forms of the organization of production and labor contributed to the accelerated construction and early introduction into operation of the Urengoy-Pomary-Uzhgorod gas pipeline.

An analysis of the situation also shows, however, that the principles and methods for opening up the ZSNGK need further development and improvement.

#### Keeping Personnel

The natural increase in the population in the rayons of West Siberia can meet no more than one-fourth of the requirements of the ZSNGK for manpower

resources. The remaining part of these resources is and will be made up of those coming from other oblasts, krays and republics of the country. And whereas in the first stage of the development of the oil and gas complex the manning of production collectives was not accompanied by any particular difficulties, since the general situation with manpower resources was less strained, the current demographic situations will complicate matters in the coming years. Today the rayons of the Volga area, the Ukraine, Belorussia and the North Caucasus, which were traditional suppliers of manpower for West Siberia, are becoming areas of a manpower shortage rather than a surplus. Therefore, in contrast to the first stage, the main task now is to establish the conditions to keep personnel from leaving.

Needed above all are more effective measures in providing workers with housing and other facilities in the social infrastructure. Despite the substantial capital investments allocated for these purposes, the problem remains acute, especially in the oil and gas producing cities in the northern part of Tyumen Oblast. The increase in the population there greatly exceeds the rate of housing construction and some people are forced to make use of temporary housing. It must therefore be a matter not only of the quantitative but also of the qualitative satisfaction of housing needs.

The extreme natural and climatic conditions, the inhospitableness of the territory, and the frequent absence of the necessary social and domestic infrastructure are the basic reasons for the low stability and high turnover of personnel. As studies by the Interdepartmental Territorial Commission under the USSR Gosplan indicate, two-thirds of the workers leave the region after having lived there no more than a year.

The reason for more than half of the resignations of oil industry workers, geologists, gas workers and power engineers is the lack of housing and places in children's preschool institutions. It is also essential to note that the majority of those quitting their jobs leave the region. According to studies by the West Siberian branch of the research institute for labor, more than 80 percent of those quitting industrial enterprises and construction organizations leave for a new place of residence beyond the boundaries of the region.

The personnel turnover and the high migratory mobility of manpower resources have a negative impact on the stability of labor collectives, labor discipline, and the general level of worker skills. The backwardness in the provision of the social infrastructure of the complex is so great that it is slowing the growth rate of oil production. Economic action is necessary to redistribute capital investments and to increase the share of resources for the establishment of the social infrastructure. Otherwise the existing problems will become even more acute when the production of oil and gas is increased significantly.

To resolve the current questions and provide for a comprehensive saving of expenditures of live labor, it is important to ensure the overall development of the region and, on this basis, to improve the territorial planning of the balance of labor. For this purpose, it is necessary for there to be a fundamental change in the existing practice regulating migratory flows. It is also necessary to improve the quality of the selection of workers from the

point of view of their occupational suitability and state of health. It is known, for example, that one-fourth of workers cannot work in the north because of their state of health. At the same time, there is frequently no medical screening, and physical examinations are carried out only formally when they come to work, with no consideration being given to the specific conditions of the north.

Practice suggests that the adaptability of the human organism to the conditions of the polar and arctic regions is completely determined in the first 3 months of one's stay there. On the basis of such observations beginning in 1974 in the Nadymgazprom Production Association and now in other organizations of Nadym and a number of cities of the northern Ob River region, labor contracts with workers for a specific time are made only after they have been in this region for 3 months. The time has come to reinforce this experience with fundamental medical research and standard documents.

It is necessary to regulate migratory flows at the national economic level and to determine the sources and regions for the provision of the complex with manpower. In this connection, it is expedient to disseminate more widely the existing experience of the Ministry of Construction of Petroleum and Gas Industry Enterprises in the redistribution of the manpower resources of mobile construction organizations, which work during the winter in the northern regions because of the weather and climatic conditions and the rest of the year at the places of their permanent location. The provision of constant employment through a work reserve at the places of the permanent location of the organization makes it possible to manipulate manpower, matching the interests of the organization and workers, sectors and regions. It is desirable to use this experience not only in the organized forms of contract work but also in separate categories and occupations of workers. Thus, in winter in the northern rayons around Tyumensk, conditions are more favorable for the transport of freight and many motor vehicle drivers are needed here during this time. With the impassable roads in the spring, summer and fall, the need for them declines sharply and they could be utilized in nearby regions: in agricultural work in Tatar, Bashkiriya and the Altai. This is not done, however, and enterprises, not having enough work throughout the year, artificially increase it, striving in this way to maintain the average wage for workers to keep them from leaving.

In this situation, the role of oblast and republic labor offices is increased. For the 12th Five-Year Plan, the number of workers in basic occupations for seasonal utilization in regional and sectorial areas in the ZSNGK and the sources of these workers need to be determined and planned targets should be determined for local labor offices.

The intrasectorial redistribution of specialists as in the experience of the enterprises of the USSR Ministry of Nonferrous Metallurgy is worthy of attention. The making of fixed-period labor contracts with them for work in the north with a subsequent return to their original location as practiced in Norilsk has proven to be positive.

To a considerable degree, the stability of personnel depends upon worker satisfaction with their working conditions. Drillers, drivers and builders

work in the north under difficult natural and climatic conditions. Especially current, therefore, are the questions of the mechanization and automation of production processes and the application of progressive forms of organizing production, labor and labor-saving technology. Often, however, these problems are still resolved inefficiently. In the press, for example, they repeatedly raised the question of the acceleration of the production of the very successful Uralmash-125A drilling unit, which makes it possible to reduce by half the number of operating personnel and to eliminate heavy physical labor completely. Its experimental models received the high evaluation of specialists more than 15 years ago. Geologists, gas workers and petroleum specialists in the north have long awaited the automatic machine. The issue of such a unit is doubtless not a simple matter. But the expenditures and efforts pay for themselves many times over. With the introduction of the automatic drilling machine, given the increasing amount of drilling, one can fundamentally improve the working conditions of tens and hundreds of thousands of people.

The working conditions in the north require special protective measures for workers, including the establishment of warm repair bases and places to warm up, the provision with hot lunches and suitable work clothes, and the application of northern versions of technology and equipment. In most cases, however, the equipment that is provided is intended for work in the temperate climatic zones. Drilling sites have no protection against precipitation and no provision is made at them for heating the workplaces. There are inadequate numbers of northern versions of motor vehicles and tractors. It therefore has become necessary to take urgent measures at the national economic level to produce northern versions of special equipment.

It also appears that the ministries and departments, whose enterprises and organizations are part of this complex, must pay close attention to the development and adoption of measures for the implementation of the 15 August 1985 decree of the USSR Council of Ministers and AUCCTU "On the Extensive Certification of Workplaces and Their Rationalization in Industry and Other Sectors of the National Economy," which will doubtless help to raise the efficiency of the utilization of the production potential.

In need of regulation is the system of regional coefficients and bonuses which in a number of cases do not stimulate the attraction and stability of personnel but sometimes contribute to unjustified manpower flows from oblast to oblast. It happens that people refuse to leave developed regions, where there is a trend toward the reduction of the need for personnel, for work in regions being newly opened up, in which the standard of living is still not high. For example, the inhabitants of Nizhnevartovsk are very reluctant to go work in the region of the Varyeganskaya group of deposits. The result is the creation of an artificial shortage of manpower resources and hence the need to bring them in from other regions of the country.

One of the factors having a negative impact on the stability of personnel is the undeveloped material base of the occupational training of personnel. The network of vocational and technical schools is being developed at a slow rate. There are still none in the cities of Noyabrsk, Novyy Urengoy, Megion and Uray. There are not enough places in the schools of Surgut, Nizhnevartovsk

and Neft'yugansk and therefore there are two or three graduating students competing for one spot in a technical school. Despite the developing shortage of drillers, only 6 of 71 schools in the oblast are training them. The material-technical base of the schools is frequently weak and most of the vocational and technical schools are located in unsuitable buildings and have no production workshops, experimental and training grounds, dining rooms or dormitories. The result is that despite the shortage of qualified personnel, a significant share of the graduates of nonspecialized schools is deprived of the possibility of acquiring working occupations at the place of residence and leaves the boundaries of the complex. At the same time, contract construction organizations systematically fail to fulfill the plans for the construction of vocational and technical facilities.

#### Developing the Duty Shift-Expedition Method

A basic source of the formation of the manpower resources in the rayons of the new industrial development was and remains the migration of people from other (basically European) rayons of the country. Because of the low stability of personnel, however, it does not permit the full satisfaction of the needs of the complex for manpower resources. This served as one of the reasons for the application of duty shift and duty shift-expedition methods (VEM) of organizing work, methods that can be viewed as a unique compensatory mechanism to help offset the problem of inadequate manpower. As you know, they provide for the performance of work in remote and newly developing rayons by means of interchangeable detachments (duty shifts and expeditions) of geologists, petroleum specialists, workers in the gas industry and forestry, and builders. The manpower is transferred either relatively short distances (50 to 200 kilometers) for a short time (from a few days to 1 month) or significant distances (several thousand kilometers) for long periods of time (from 1 month to 6 months or longer). Thus, the duty-shift method is based upon the intra-rayon utilization of manpower resources with a regular change of worker contingents every 5 to 10 days. It is used to conduct operations at remote deposits with a relatively small amount of work, where it is economically inexpedient to build stationary settlements with a developed welfare infrastructure.

Intra-oblast and interregional VEM provide for the inter-rayon (intraregional) and interregional utilization of production personnel, respectively. Compared with the duty-shift method, they are rational when the sites for the application of labor are far removed from the places of permanent residence with a longer period of stay in the duty settlement.

The application of the interregional VEM was sporadic in the beginning stage of the industrial development of the rayon. However, the shortage of petroleum personnel with the necessary skills and also the absence of the appropriate welfare infrastructure meant that the method began to be introduced intensively starting in 1977. In a short time it became possible to concentrate manpower in important sections of the complex and to facilitate in the first stages the resolution of a number of complex questions of a social nature that inevitably arise in the settlement of workers and their families in new places of permanent residence.

At the present time in the main sectors of the complex, one out of every five or six workers is working under VEM and in three very large production associations of Glavtyumenneftegaz--Nizhnevartovskneftegaz, Surgutneftegaz and Yuganskneftegaz--one out of three workers is working only under the interregional duty shift method. At the present time, 40 percent of the drilling is being done by VEM. In the construction of facilities of the Ministry of Construction of Petroleum and Gas Industry Enterprises, more than half of the construction and assembly and start-up work is done by VEM. (Footnote 1) (It is essential to note the lack of statistical accounting for the number of people working under VEM in the basic sectors of the complex. The estimate of those working under various methods--in Glavtyumenneftegaz, for example--was made in such a way that all methods other than the interregional duty shift-expedition method are considered traditional.)

The increase in the amount of oil and gas production to the planned levels requires a substantial increase in the number of people working under VEM for the complex as a whole as well as for the individual ministries that comprise it. At the same time, one cannot view the social and economic processes in the organization of VEM as being identical from the point of view of "good" or "bad" for all sectors of the region. The existing diversity of the nontraditional methods of organizing labor requires an individual approach in determining the forms of their development and the scope and limits of their practical application.

Thus, the regional form of VEM, though it will require resolution of a number of social and domestic problems, is becoming a permanent part of the work practice of the basic sectors of the complex. The utilization of an interregional VEM for a number of categories of workers evokes fundamental objections. For the builders of main gas lines, by the nature of their work and the natural and climatic conditions (the primary work is done during the winter period), interregional transfers are a progressive form of organizing labor that makes it possible to increase the mobility of construction organizations and to make efficient use of manpower resources. The specific nature of the work of petroleum specialists and gas workers having to do with the drilling, operation and repair of wells requires that places of residence be located as close as possible to the work projects. In practical terms, there is enough work here for these categories of workers to last 40 to 60 years at one and the same location. Of importance here is the ensuring of uninterrupted work during the course of the day, week, month, etc. In interregional transfers, therefore, it is impossible (because of the "work-rest" cycle) to achieve the evenness that is typical for workers with permanent residence. And whereas in the first stage, with the rapidly growing production of oil and the lag in the construction of housing, this measure--although forced--was justified, the interregional duty shift becomes more and more inefficient in the subsequent stage of the development of the region. In addition to the high attendant expenditures in the organization of duty settlements as well as transport and other outlays, the interregional duty-shift method is characterized by less efficiency in comparison with the results of the work of enterprises and organizations applying the stationary and intraregional methods. The frequent transfers--and over substantial distances at that--fatigue the workers and their labor productivity is lower



than that of the local residents. This is clear in a comparative analysis of the results of the work of the drilling brigades of Glavtyumenneftegaz. Whereas the average annual drilling progress of one drilling brigade of 25 members who are included in the enterprise work force but live in other regions amounts to 30 kilometers and that of a contract brigade from other territorial organizations of the ministry is 40 kilometers, that of the same kind of brigade with permanent residence in the places where the enterprises are located amounts to 50 kilometers. In this way, for one and the same amount of work that is performed by 1,000 local workers, it is necessary to bring in 1,300 to 1,500 people by air from other regions. Without even taking into account the expenditures, it is hardly expedient to do this, given a shortage of manpower resources.

The natural and climatic conditions, the extent to which the rayon is habitable, the state and reliability of communications, the conditions of production and construction, and many other factors effect the choice of the work and rest systems. The latter, in turn, have a substantial influence on the efficiency of work and on the stability of personnel. At the present time, utilizing the conclusions of medical and biological research and the available experience of Soviet and foreign specialists, taking into account the specific nature of natural conditions and social factors, different labor and rest schedules are used. Practice indicates that most applicable under the duty shift are weekly cycles (4, 5 or 6 days of work with a 12-hour working day) for workers with permanent residence and cycles of about 1 month (15 days of work and 15 days of rest) for workers under intraregional transfers. An even longer cycle is desirable for the interregional duty shift. As experience shows, however, long periods of duty with prolonged work shifts lead to more fatigue and a reduced working capacity. After a lengthy rest, in turn, labor productivity also declines as a result of the disturbance of the dynamic stereotype. In organizing the VEM, therefore, the work and rest schedules should be established taking into account the specific nature of the work as well as medical recommendations.

In selecting and justifying work and rest schedules, it is certainly necessary, in addition to the medical evidence, to take into account the technological features of production. For petroleum specialists and gas workers, for example, they must approximate stationary systems for the purpose of ensuring continuity and a high degree of evenness in the work. The specificity of the work of builders, on the other hand, requires an increase in the mobility of construction organizations, hence the expansion and improvement of forms of VEM. One of the progressive directions for resolving social and domestic questions in the complex, including that of the introduction of progressive work and rest regimes, is the increase in the level of the industrialization of construction through the application of unit-block, nodal, flow-line and other methods and the planned concentration of manpower in the most important sectors, which will help to reduce the time of the workers in the duty shift. The work experience of the Sibkomplektomontazh Association of Glavtyumenneftegazstroy indicates that the introduction of industrial construction methods and the transfer of most (up to two-thirds) assembly work to plant conditions significantly reduce labor expenditures at construction sites, raise the quality of work, and help in the optimum combination of traditional and duty shift-expedition methods of work.

Thanks to the high level of prefabrication of the output of assembly and completing enterprises, mobile assembly subdivisions can be relatively small in number (about 15 percent of the total number of the organization) and highly mobile. This also makes it possible to reduce the absolute and relative number of workers in duty shifts and expeditions. In addition, it becomes possible to utilize people during most of the year in work with a stationary system in the places of their permanent residence, which is also an important factor in the stabilization of personnel.

A certain amount of positive experience in the application of different work and rest schedules, including with an extended work cycle, has been accumulated, for example, in the laying of gas mains.

The special nature of the duty shift-expedition method of work is expressed in the fact that, along with the functions of stationary organizations, it is necessary to carry out additional functions in the preparation of production, including the rebasing of equipment, the development of duty and field towns, the establishment of social and domestic services there, and the transport of shift personnel. At the present time, these functions--often determining the very possibility of the performance of work apart from the place where the organization is located--are distributed among line managers and specialists of technical and economic divisions.

It is clearly necessary to review and resolve the question of the establishment of specialized structural subdivisions within the enterprises and organizations to prepare and perform work under nonstationary conditions. The tasks of such a subdivision must include the building and operation of duty and field towns, their rebasing and preparation at the new location, the transfer of workers, etc. Preceding from the work experience of the mobile construction and assembly organizations of the Ministry of Construction of Petroleum and Gas Industry Enterprises, it is expedient to include among the subdivisions for the preparation and provisioning of expeditions groups for municipal and domestic and general cultural services and organizations for the transfer of shift personnel as well as the rebasing and engineering preparation of the work and housing.

One of the forms of improving VEM is the involvement of petroleum extracting enterprises located in the European part of the country in the development of deposits in West Siberia. Initially such tasks were assigned in the drilling of wells and later they expanded the types of work and began to include the repair and operation of wells. At the present time, experience already exists in the transfer of an isolated deposit to development by an organization subordinate to an association located in the European part of the country.

Under the existing system, however, associations working under contract have no incentive to increase the amount of drilling, as this does not lead to an increase in their extraction of petroleum but, on the contrary, shunts "to the side" significant forces and resources and is secondary work for them. In particular, these associations do not provide the expeditions with engineering and technical specialists but generally man them with local personnel and they o not give the proper attention to the improvement of the housing and other living conditions of duty-shift workers. This doubtless requires additional

study of the questions of intrasectorial planning, financing, personnel management, and the coordination and interrelationships of territorially and technically interdependent organizations subordinate to different associations. The spread of improved experience in the utilization of the "contract for the deposit" will have special importance for the preservation of a high pace of development of new oil deposits in the northern part of Tyumen Oblast as well as in other regions of the country and will make possible the efficient utilization of the internal reserves of the Ministry of the Petroleum Industry (presence of highly qualified personnel in the associations in the European part of the country).

Thus, the specific conditions of development require a differentiated approach to the determination of the optimum proportions in the application of particular methods of organizing labor not only in the sectorial but also in the intrasectorial and regional aspects. In so doing, it is necessary to be creative in resolving the entire complex of questions involved in the organization of labor, planning, the provision of incentives, and the determination of the duration of work and rest schedules. It is essential to analyze and evaluate comprehensively the possibilities for the application of some method or other of organizing labor or for a combination of methods.

Disproportions in the level of the labor productivity of those working under different methods must be taken into account in resolving the question of the rationality and limits of the utilization of any of the methods. In the current stage, the task is to see that the relationship of the mentioned forms of performing the work does not come about randomly but that it be established on the basis of the social and economy efficiency of the national economy.

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MAIN DIRECTIONS IN FURTHER RECONNAISSANCE AND EXPLORATION WORK FOR PETROLEUM  
AND GAS ON KURA-IORI INTERFLUVE

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA NAUK O ZEMLE in  
Russian No 4, Jul-Aug 85 pp 24-32

[Article by Salayev, S.G., Averbukh. B.M., Chikovani, E. V. and Gadzhiyev, Z. R.]

[Abstract] Interest in the possibilities of discovery of petroleum and gas in the Eocene-Cretaceous lithological-stratigraphic complex of the Kura-Iori interfluvial has increased since the discovery of a highly productive petroleum deposit in Eastern Georgia in 1974. This has resulted in a number of studies by the authors, using various geological and geochemical criteria, for evaluating the prospects of different stratigraphic subdivisions of the Paleogene and Upper Cretaceous in individual regions of the interfluvial. This work is briefly reviewed. As a result, it was possible to define the most promising lithological-stratigraphic complexes of the Upper Cretaceous-Eocene interval on the interfluvial. The most promising zone is the axial part of the Iori downwarp, with the prospects for finding petroleum and gas decreasing with distance from the axis. Data obtained by a number of methods (including drilling) in 1979-1983 greatly expanded the volume of available data and revealed economic feasibility of extracting petroleum and gas from Eocene and Lower Maykop deposits. More than 20 anticlinal folds and other promising structures have been discovered in the Cretaceous-Eocene lithological-stratigraphic complex. Figure 1 shows a comparison of sections of Eocene deposits penetrated in different parts of the interfluvial; Fig. 2 is a structural map of the interfluvial area along the top of the Middle Eocene; Fig. 3 is a schematic map of the prospects for finding petroleum and gas in Paleogene deposits. This has made it possible to define the best areas for geophysical and exploration work on the interfluvial. Figures 3; references: 11 Russian.

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OIL AND GAS

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EVALUATION OF PROSPECTS FOR FINDING PETROLEUM AND GAS ON WESTERN SHELF OF  
SOUTHERN CASPIAN

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA NAUK O ZEMLYE in  
Russian No 4, Jul-Aug 85 pp 33-38

[Article by Narimanov, A.A.]

[Abstract] During more than 30 years of work on the western shelf of the Southern Caspian deep exploratory drilling has been carried out in 19 areas, but early in 1984 only 6 had yielded commercial quantities of petroleum and gas. This past work is briefly reviewed. During that period many different, frequently contradictory concepts concerning the geological development and structure of individual structures and zones have been published. The lack of a clear picture of the mechanism and time of formation of traps and pools has made it difficult to choose the best methods for conducting exploration work. All accumulated data have been reviewed and integrated and a clearer picture has now been obtained. This has made it necessary to re-evaluate qualitative and quantitative predictions of petroleum and gas reserves in different parts of the western shelf. This made it possible to compile a map (Fig. 1) showing the prospects for finding petroleum and gas on the shelf which also indicates the initial potential reserves in the Pliocene-Quaternary deposits and at the top of the Paleogene. This map shows the area divided into two separate regions of potential presence of petroleum and gas, differing with respect to both thickness of the complex and nature of the petroleum and gas saturation section. Individual parts of these two regions are discussed. A number of sites are recommended for increased attention. Figures 1; references: 12 Russian.

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OIL AND GAS

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FEATURES OF GEOLOGICAL SECTIONS OF MESOZOIC AND CENOZOIC DEPOSITS OF  
STRUCTURES IN WESTERN PLUNGING OF BEKE-BASHKUDUK SWELL IN SOUTHERN MANGYSHLAK  
IN RELATION TO PETROLEUM AND GAS CONTENT

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA NAUK O ZEMLYE in  
Russian No 4, Jul-Aug 85 pp 94-100

[Article by Narimanov, A. A.]

[Abstract] The Beke-Bashkuduk swell is one of the major anticlinal zones of the Central Mangyshlak-Ustyurt system of uplifts. It is on the northern marginal part of the Yuzhno-Mangyshlak downwarp and extends in a narrow tongue in a westerly direction, plunging in the direction of the sea. An interpretation of available geophysical materials, including drilling data, has now made it possible to draw conclusions concerning the prospects for finding petroleum and gas in the Mesozoic and Cenozoic deposits in the entire western plunging of this structure. In this sector it was found that westward there is a decrease in the thickness of Cretaceous, Jurassic and possibly Triassic deposits. With respect to the overall increase in the thickness of the entire Mesozoic-Cenozoic complex of deposits, this occurs at the expense of Neogene and Paleogene sediments. The geological sections of these structures in the Neogene-Triassic interval can be broken down into two parts: upper, with increased clayiness of rocks, and lower, with the presence of permeable rocks capable of serving as petroleum and gas collectors. The reformation of petroleum and gas deposits in the Middle Jurassic and Lower Cretaceous deposits of the western plunging of the swell is attributable to lateral migration of hydrocarbons. Prospects for finding petroleum and gas in the considered sector, both on the land and under the sea, are related for the most part to the lower half of the section, in the Lower Jurassic and Triassic (and possibly Permian) deposits, which in the most down-plunged parts of the swell are primarily gas-bearing, whereas the higher parts are petroleum- and petroleum-gas bearing. It is now possible to carry out a program of exploration and drilling work on a more effective basis. Figures 1; references: 4 Russian.

5303/7687  
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## COAL

### MODERNIZATION OF COAL-BURNING BOILERS IN THE UKRAINE

Moscow EKONOMICHESKAYA GAZETA in Russian No 3, Jan 86 p 15

[Article by A. Bocharov, manager of the trust Donetskguleavtomatika: "Where the Coal Is Lost"]

[Text] Every day in the coal industry of the Ukraine, about 7 million tons of standard fuel is burned to obtain thermal power for heating and public and domestic sanitation needs and, in the winter, for heating the air used in ventilating the shafts.

The boilers in operation are equipped with combustion chambers for the layered burning of high-quality graded coal. Now, however, it is more and more often necessary to make use of high-ash and low-quality coal. But it is irrational to burn these coals in such combustion chambers. The heat output and efficiency of the boilers is often no more than 50 percent of the certified level.

Nevertheless, low-quality fuel can be utilized significantly more efficiently if it is burned in a low-temperature boiling layer. Under this method, each particle of coal up to 13 millimeters in size is burned in a suspended state and the increased quantity of air provides for a complete burning of the carbon, whereas in existing combustion chambers its residue is often more than 30 percent. The technology for the burning of coal in a low-temperature boiling layer is described in detail in many publications.

To introduce this technology, it is necessary to modernize operating boilers. The expenditures for reconstruction are not great, because the basic industrial equipment remains unchanged. Instead of the existing fire grate, a downcomer bell-type grating is installed, the blast ventilator and exhaust fan are replaced with more powerful units, some changes are made in the control and measuring instruments and automation, and a special system is installed for firing. And that is all. The capital investments pay for themselves in 5 to 10 months.

The enterprises of the Ukrainian SSR Ministry of the Coal Industry are pioneers in mastering the new technology. Specialists from our trust have been working on the reconstruction of boilers since 1983. A specialized cost accounting section has been established in the trust. In 3 years, boilers

with a productive capacity of 4, 6.5, 10 and 25 tons of steam per hour and two chambers for the drying of coal have been put into operation. A scheme has been developed for the control of boiler units, which makes it possible to carry out the industrial process automatically and provides for the burning of almost all ranks of coal with an ash content of up to 50 to 60 percent.

Anthraccitic coal slack, wastes of coal enrichment, rock siftings with an ash content of 80 percent, and brown coals of the Chelyabinskoye, Bashkirskoye and Aleksandriyskoye deposits. Thus, during the last heating season, two boilers of the mine administration imeni SOTSIALISTICHESKIY DONBASS newspaper of the Donetskugol Association worked using the siftings of small rock cuts, which are normally taken out to rock dumps. The combustion chamber for export designed, manufactured and introduced by our specialists at the Mospinskaya Mine made it possible to renounce imported coals and release 16 stokers in one boiler room.

The application of new technology makes it possible to bring into the fuel and energy balance high-ash coals that accumulate in the shafts and coal enrichment factories. This reduces the need for high-quality coal. In addition, there is a significant reduction in harmful emissions into the atmosphere and an increase in efficiency and heat output.

About 40 modernized boilers are in operation in our mines. That is not a large number, especially when one considers that their capacity is not great.

The circumstance that we have not been successful in resolving all technical questions is felt, of course, and the qualifications of the service personnel in the boiler shafts must be raised. But in addition to purely technical problems, there are also organizational problems.

The modernization of the operating boilers is being carried out in close cooperation with the Central Boiler and Turbine Institute imeni Polsunov. The institute is located in Leningrad. But many questions are arising that require prompt resolution. It would be desirable for a group of institute specialists to be at Donbass as well (there are branch divisions of the boiler and turbine TsNIIP [Central Research Institute and Planning Institute] in other regions). Or at least the Rostov Planning and Design Division No 40 should pay more attention to us.

There is great interest in the new technogy. Delegations from different regions of the country come to use almost daily for experience. But the burning of coal in a low-temperature boiling layer is being introduced slowly.

The reason is apparently that there is no plan for the centralized reequipment of boilers. In the meantime, it is essential to acquire diverse equipment and instruments. It is necessary to come to an agreement with someone to procure some things.... All of this consumes a great deal of time.

Evidently, maximum results could be attained using large-capacity boilers, primarily at power enterprises. This supposition is in need of practical confirmation. And in our view, the USSR Ministry of Power and Electrification and the Ministry of Power Machine Building could easily design and test such equipment.



## COAL

UDC 662.74"312":662.74"313"

### COAL GASIFICATION STUDIES EXAMINED

Moscow UGOL in Russian No 1, Jan 86 pp 16-17

[Article by Institute of Mineral Fuels engineer N.A. Yershova: "The Modern State and Prospects of Coal Gasification"]

[Text] The draft of the Fundamental Areas of Economic and Social Development of the USSR for 1986-90 and for the period to the year 200 projects the development and incorporation of efficient methods for the integrated utilization and processing of raw materials, as well as the broad-scale replacement of natural materials with synthetic ones in productive use.

At the same time, scientific and technical preparedness to produce oil and gas replacements is still inadequate. Topical in this regard is the development of efficient technological processes for producing synthetic gaseous fuels using coal, the most widespread type of mineral fuel.

Work is being conducted in many countries of the world in the area of coal gasification with the aim of creating highly productive and economically efficient processes for producing process and power gas. Currently, the most familiar methods of solid fuel gasification in gas generators are the following:  
the gasification of solid fuel in lump form in a stationary layer under pressures of up to 2-2.5 megapascals in a steam-oxygen blast (the Lurgi method). The gas productivity of modern gas generators with this method exceeds 51,000 cubic meters per hour [1];  
the gasification of fine-grained fuels in a fluidized bed at atmospheric or increased pressure in a steam-oxygen or steam-air blast (the Winkler method and its modification). The productivity of the most powerful gas generators using a steam-oxygen blast is 57,000 cubic meters per hour, and using a mixture of steam and air is 105,000 cubic meters per hour;  
the gasification of coal dust at high (up to 2,000 degrees Celsius) temperature in a moving flow with atmospheric and increased pressure in a steam-oxygen blast. The gas productivity of the generators with this method is 50,000 cubic meters per hour [1].

According to the materials of [2], one of the areas of further improvement for industrial gas generators is increasing their productivity. The optimal gas productivity of gas generators for future enterprises should reach 300,000 cubic meters per hour [2].

Moreover, scientific-research, planning, design and test work is being conducted on other promising methods (aside from the three basic gasification methods above). The principle trend in the development of new solid-fuel gasification processes is the application of higher temperatures and pressures, as well as a fluidized bed. Work is being conducted in this area in the GDR, the FRG and the United States.

Work is being conducted in the USSR on the creation of steam-gas power installations integrated with solid-fuel gasification under pressure in a steam-air blast, since the most progressive area is the combination of fluidized bed with high pressure. The solution of this problem will make possible the efficient utilization of sulfurous solid fuel in installations that are more efficient than steam-turbine power plants.

A gasification process for various coals in a fluidized bed under pressure with the high-temperature gas scrubbing of dust and sulfurous compounds is being developed at the Institute of Mineral Fuels [IGI] based on previous research. The process has also been tested with a steam-oxygen blast for producing process gases. A test installation has been built at the Moscow Coke-Oven Gas Plant with a productivity of 1,000 cubic meters of gas per hour. Calculations executed at IGI confirmed the expediency of using fluidized-bed coal gasification compared to utilizing the Lurgi gas generators for this aim.

According to the work of [3], we cite the expenditures on the production of gas from Kansk-Achinsk coal calculated per 1 ton of standard fuel using differing gas generators.

|                                      | Lurgi<br>gas generator | Fluidized-bed<br>gas generator |
|--------------------------------------|------------------------|--------------------------------|
| Capital investment, rubles           | 22.2                   | 15.6                           |
| Cost, rubles                         | 9.4                    | 8.2                            |
| Recurring expenditures, rubles       | 12.1                   | 10.1                           |
| Correlation of expenditures, percent | 100.0                  | 84.1                           |

In creating new gasification methods, much attention is devoted to the search for secondary energy sources and in particular the utilization of the heat of nuclear reactors, which will make possible a reduction in fuel expense in gas production. An advantage of the given area also lies in the possibility of organizing the absorption of additional heat in the gas generator's reductive zone where the reactions are taking place with the appearance of heat, which is a basic problem in the further improvement of coal gasification technology in the sphere of raising the unit capacity of gas generators.

Raising the production of solid mineral fuels is currently linked with the increasing expenditures on mine construction caused by the necessity of using up reserves at great depths and in difficult geological mining conditions. In this case, the working conditions become more difficult and the technological indicators worsen at the same time. A reduction in coal production expenditures is only possible by developing and assimilating into production new recovery and processing methods. One of these methods could be underground coal gasification (UCG). The incorporation of underground coal gasification technology will make possible the fuller utilization of coal resources--an increase in the coefficient of reserves extraction, a broadening of the raw material base of industry (fuel and chemical raw materials), sulfur, phenols, etc., as well as the resolution of a number of social tasks--easing the labor of miners and decreasing environmental pollution [4].

Practical work on underground coal gasification began in our country in the 1930s and has continued up until today. Several stations were built that processed in excess of 35 billion cubic meters of gas [5] over the period of their operation.

Two underground coal gasification stations using an air blast are currently in operation--at the Angrenskoye Field and in the Kuznetsk Field. Gas produced at the Yuzhno-Abinskaya Station with a heat of combustion per 1 cubic meter of gas of 840-970 kilocalories is used in the boiler rooms of the cities of Kiselevsk and Prokopyevsk. The productive capacity of a station is 60 million cubic meters of gas in the winter months and 20 million cubic meters in the summer [5]. The Angrenskaya Station is built on a coal field of the Uzbek SSR. It has supplied the Angrenskaya Thermal Electric Power Station since 1961.

The operating UCG stations are small in productive capacity and correspond in quantity of heat production to mines of 100,000-400,000 tons of coal a year. The small capacity of these stations and other operative negative factors (low heat of combustion, high proportionate cost of electrical energy in conducting the process, gas leakage) are causing relatively high capital investments and operating costs. Currently the recovery of coal by traditional methods requires smaller expenditures than the production of the same quantity (by heat) of fuel by underground gasification. At the same time, improving underground gasification technology and increasing the capacity of the stations can lead in the future to a significant reduction in expenditures on executing the operations of converting coal to gas. Thus, the Yuzhno-Abinskaya and Angrenskaya stations will become profitable in the event that their productive capacities are increased to 450-500 million cubic meters and to 1.5 billion cubic meters of gas a year respectively.

In practice, underground coal gasification produces gases that are used principally in power engineering. The results of technical economic

calculations [6] executed at IGI on the production of 1,000 kilowatt-hours of electricity using gas produced by underground gasification, as well as the combustion of ordinary coal, are presented below.

|                                      | Gas produced at<br>a UCG station | Combustion of<br>ordinary coal |
|--------------------------------------|----------------------------------|--------------------------------|
| Capital investment, rubles           | 43.9                             | 43.0                           |
| Operating costs, rubles              | 8.4                              | 9.6                            |
| Recurring expenditures, rubles       | 15.0                             | 15.8                           |
| Correlation of expenditures, percent | 95.0                             | 100.0                          |

These data confirm the efficiency of using gas from underground coal gasification to produce electricity. The economic efficiency of UCG can be raised by enriching the oxygen air blast.

In the process of scrubbing UCG gas of harmful impurities, such valuable products as sulfur, phenol, carbonic acid, ammonium fertilizers and others can be obtained from it, the production of which substantially raises the economy of the UCG stations.

The currently realizable underground coal gasification process does not exhaust the technical, economic and social possibilities that are potentially at its disposal. The expedient further development of scientific research and testing work on improving the reviewed technology should be considered in this regard. The whole set of work must be directed at raising the power efficiency factor of the process as a generalized technological indicator greatly determining the level of expenditures on the production of output and the degree of efficient utilization of coal resources.

#### Conclusions

1. The efficiency of using gaseous fuel within the relative limitation of its natural resources testifies to the necessity of developing economical technological processes for producing coal-based synthetic gases. At the same time, relatively large expenditures are associated with the production of gases from coal.
2. The principal ways of improving the economics of coal gasification methods are increasing the capacity and efficiency factor of gas generators, as well as increasing the heat of combustion of the synthetic gases produced.
3. The production and utilization of synthetic gas as a process raw material will expand the sphere of application of coal and will have a positive effect on the economic indicators of the coal gasification process.

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CSO: 1822/182

## COAL

### REVIEW OF COAL PIPELINE CONSTRUCTION

Moscow GUDOK in Russian 23 Jan 86 p 4

[Article by I. Drozdova: "Our Transportation Colleagues: Coal via Pipes"]

[Text] In our traditional conception, pipelines transport water, gas oil and petroleum products. And suddenly--a coal pipeline. How does it work?

In general, quite simply. It turns out that crushed coal can be transported in a powerful stream of water. Just recall what a torrent is capable of doing. We will apply this very principle to transport solid substances in pipes. For example, coal is successfully pumped in the Kuznetsk Coal Field in Siberia in one of the pipelines from the Yubileynaya Mine to the West Siberian Metallurgical Combine, and in another from the Inskaya Mine to the Belovskaya State Regional Electric Power Plant. And iron-ore concentrate is transported in a three-kilometer pipeline at the Severnyy Ore-Enrichment Combine in Krivoy Rog. Such examples are numerous.

Why is a coal pipeline necessary? The fact is that pipeline transportation, enjoying a preferential rate of development in the 1960's, has significantly outstripped its "colleagues" and provides for an increase in labor productivity, in contrast to railroad transportation, of 9-12 percent. But that is not all. It can pass where the laying of railroads would cost triple the price or is still impossible.

"Already in the Soviet Union, billions of tons of solid free-flowing materials, ferrous and non-ferrous ore enrichment by-products, building materials and raw materials for the production of chemical industry products are "pumped" in a pulp every year, but, it is true, over short distances. Scientists and specialists consider that the time has come not for individual "stubs," but for trunk pipelines for the hydro-transport of coal and iron-ore concentrates. This will aid the more rapid resolution of transportation problems within the framework of the Prospective Energy Program to the year 2000. This, by the way, is necessary partly to relieve railroad transport in the industrial regions of Siberia, the Urals and the

Kola Peninsula," relates Ye. Olifinskiy, the director of the All-Union Scientific Research and Design Planning Institute of Pipeline Hydro-Transport.

The institute is quite young (it is only two years old), but the scope of its research is exceedingly broad. The planning of a unique coal pipeline that will extend from the Inskaya Mine to the Novosibirsk TETs is proceeding at top speed. The construction of a 220-kilometer trunk pipeline for transporting iron-ore concentrate from the Stoylenskiy Ore-Enrichment Combine to the Novolipetskiy Metallurgical Plant imeni Yu.V. Andropov is projected in the next few years.

A dilemma arose before the scientists and specialists. It is possible, of course, to utilize already existing technology for the preparation, delivery and burning of the coal and water mix with roughly equal proportions of coal and water in it. But wouldn't methods that permit an increase in the concentration of the precious raw material in the mixture be more advantageous?

The Soviet specialists preferred the unexplored route. This was explained not only by a striving toward the new, but by strictly economic calculations. The transportation of a highly-concentrated (with a coal content in the mixture of up to 70 percent) coal and water suspension in pipes requires, first of all, considerably less water. Secondly, it is easier to pump such a mixture in branching pipelines, and to accumulate and store it. Thirdly, the equipment suffers less wear. And most importantly--the thermal electric power station will be able to receive fuel ready for use.

But preliminary economic estimates are one thing, and it is another when they are based on the most modern and reliable technical solutions. After all, it isn't that simple to "push" a highly-concentrated mixture of coal and water in a pipeline. It can harden like a cement mixture, or deposit sediment. Chemistry came to the rescue. Special active substances must be added to the suspension to give it fluidity. Specialists call them reagents. But this is only half of the solution to the problem. It is still necessary to crush the coal in such a way that provides the optimal ratio of solid particles.

All of these complicated tasks are being resolved successfully by the specialists of the institute in cooperation with the scientists of the USSR Academy of Sciences, Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] and Minugleprom [Ministry of the Coal Industry]. Several foreign firms also took part in the planning of the Belovo--Novosibirsk coal pipeline (the first construction project of its scope in the world).

The hour is not far off when the word "coal pipeline"--the new reality of modern transportation--will become as well-known and understandable as the words gas or oil pipeline.

## COAL

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## PROSPECTS FOR DEVELOPING LOCAL BASINS TO REPLACE DONBAS COAL

Kiev UGOL UKRAINY in Russian No 7, Jul 85 pp 23-24

[Article by S. D. Pozhidayev, candidate of geological and mineral sciences, N. P. Tkachenko, engineer, and P. G. Boyko, engineer, Dnepropetrovsk Section of IMR [Institute of Mineral Resources]: "Feasibility of Reducing Shipments of Power-Plant Coal to the Ukraine"]

[Text] The prolonged and intensive exploitation of the Donbas has brought about considerable depletion of coal reserves in productive beds and complicated mining and geological conditions. For several years the Ukraine has not only been shipping coal, but also obtaining it from other basins. In connection with this the opinion has developed that there will be an inevitable decline in the importance of the Donbas in satisfying the future demand for coal of the southern and central European parts of the country. To validate this prediction or refute it it is necessary to carry out complex research on the potential output of the country's principal coal basins, the prospects for change in the national economy's coal requirements, the development of the transportation system, environmental protection, etc.

Nonetheless, a comparison of the export and import of power-plant coal in the UkSSR demonstrates that the capabilities of the Donbas are still quite large. In the 10th Five-Year Plan the Ukraine exported about 20 percent of coal mined, and in 1982 exports relative to 1975 declined by seven million tons, including two million tons of power-plant coal. The republic imported about 12 percent of its coal requirements. From 1975-1982 imports increased by nine million tons, including three million tons of power-plant coal.

Fuel is delivered to 41 power plants in the UkSSR, which are combined into eight power systems. By quality, power-plant coal requirements are divided into two groups: utilization of grades D and G coal, and of grades A and T coal.

In connection with the shortage of power-plant coal and the decline in the structure of coal and its derived products, there has been a sharp increase in recent years in the importation of power-plant coal from other basins in the country. Between 1975 and 1982 coal was shipped from the Kuznetsk, the Pechora (Inta coal and intermediate products of the Cherepovets Coke and Chemical Plant



of the USSR's Minchermet [Ministry of Ferrous Metallurgy], the Karaganda, and other basins.

It is clear from the table that the amount of Kuznetsk coal increased at an irregular rate up to 1980, and then declined somewhat. Imports of Pechora and Georgian coal remained approximately level, and coal deliveries from the Eastern Donbas declined. In 1982, 35 percent of the coal was shipped from the Silesian Basin (in Poland), 21 percent from the Eastern Donbas, 18 percent from Pechora, 13 percent from Karaganda, 12 percent from Kuznetsk, and 1 percent from the Georgian SSR.

| 1)           |                            | 2)                         |      |      |      |      |      |      |      |
|--------------|----------------------------|----------------------------|------|------|------|------|------|------|------|
| Наименование |                            | Ввоз угля по годам, млн. т |      |      |      |      |      |      |      |
|              |                            | 1975                       | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
| 3)           | Угольные бассейны:         |                            |      |      |      |      |      |      |      |
| 4)           | Кузнецкий . . . .          | 0,64                       | 1,36 | 0,81 | 2,60 | 2,70 | 3,24 | 1,90 | 1,15 |
| 5)           | Карагандинский . . . .     | 1,70                       | 1,90 | 0,12 | 0,32 | 0,61 | 0,45 | 0,98 | 1,16 |
| 6)           | Печорский . . . .          | 0,90                       | 0,75 | 1,03 | 0,84 | 0,72 | 0,63 | —    | 1,70 |
| 7)           | Донецкий (РСФСР) . . . .   | 2,74                       | 3,87 | 3,04 | 2,45 | 2,57 | 2,69 | 3,05 | 1,93 |
| 8)           | Силезский (Польша) . . . . | —                          | —    | —    | 0,08 | —    | 0,36 | —    | 3,21 |
| 9)           | Грузинская ССР . . . .     | —                          | —    | —    | —    | 0,24 | 0,09 | 1,00 | —    |
| 10)          | Месттоп РСФСР . . . .      | —                          | —    | 0,05 | —    | 0,77 | 0,69 | 0,64 | —    |
| 11)          | Всего . . . . .            | 5,98                       | 7,88 | 5,05 | 6,29 | 7,31 | 8,15 | 7,57 | 9,15 |

Key:

- |   |  |
|---|--|
| 1. Origin                               | 7. Donetsk (RSFSR)                         |
| 2. Annual coal imports, in million tons | 8. Silesia (Poland)                        |
| 3. Coal basins                          | 9. Georgian SSR                            |
| 4. Kuznetsk                             | 10. RSFSR Mesttop [not further identified] |
| 5. Karaganda                            | 11. Total                                  |
| 6. Pechora                              |  |

Coal delivered for power uses can be classified by grade and class as follows: 11-22 percent anthracite (ASh, AS, AM, and AR) and its intermediate products, 15-18 percent long-burning coal (DR) and its intermediate products, 14-28 percent Karaganda gas coal (KGR<sub>2</sub>) and its intermediate products, 11-46 percent Pechora coal (DR+GR+TR) and its intermediate products, and 4-35 percent gas coal (GR) from the Silesian Basin. Kuznetsk coal is the most valuable as power-plant fuel. Its calorific value exceeds that of the Donetsk, Karaganda, and Pechora basins, and it has a low ash content. The average ash content for coal shipped to customers is 11.8 percent for the Kuznetsk Basin, 15.4 percent for Donetsk, 23.4 percent for Karaganda, and 20.1 percent for Pechora. Kuznetsk coal is also better in sulfur content, which amounts to 0.6 percent. The sulfur content of Pechora coal is three percent. Its high calorific value and relatively good mechanical stability makes it possible to burn Kuzbas coal in various types of furnaces.

Analysis of costs over several years is evidence that it is inappropriate to ship power-plant coal long distances to the Ukraine. The cost per ton of Kuznetsk coal stayed at the same level from 1975 to 1982 (17.36-17.33 rubles) and shipping costs were 10.28-10.81 rubles. The corresponding costs for Karaganda were 13.87-15.58 rubles and 8.2-8.46 rubles, and for Pechora coal 13.5-16.22

rubles and 6.5-9.37 rubles.

Fluctuations in the cost of imported coal were due to fuel quality. For comparison let us look at the costs of obtaining and transporting it from the Donbas. In 1975 the cost to produce one ton coal was 12.74 rubles, and in 1982 it was 10.71 rubles, and shipping costs were 1.33 and 1.43 rubles, respectively. When you consider rail transport and the return trip, it is obvious that it will be economically unadvisable to ship power-plant coal to the Ukraine.

The republic has a developed raw-material base -- more than 100 sectors -- at which new mines could be built. The choice of sectors for the construction or reconstruction of mines can be broadened by including fields with "briny" coal (Bogdanovskiy in the Northern Donbas and Novomoskovskiy in the Western Donbas). The output of power-plant coal can be increased by working beds with lower standards of power and ash content in areas that have been developed.

The shortage of solid power-plant fuel can also be made up by building an open pit with an annual output of nine million tons at the Novodmitriyevskiy brown coal field, and by developing the relatively shallow beds of power-plant coal in the Western Donbas, especially in Lozovskiy Rayon and in the northern part of Krasnoarmeyskiy Rayon. For a protracted period, therefore, the UkSSR is in a position to satisfy its own requirements for solid power-plant fuel.

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## TRANSPORTING ALKALINE COAL BY SLURRY TECHNOLOGY

Kiev UGOL UKRAINY in Russian No 7, Jul 85 pp 35-36

[Article by Yu. F. Vlasov, candidate of technical sciences, and A. A. Krut, candidate of technical sciences: "Parameters of Hydraulic Transport of Coal with a High Alkaline-Metal Content"]

[Text] The country's scientific organizations have been conducting comprehensive research to investigate the properties of coal with a high content of alkaline metals and to develop demineralizing technology. When utilizing hydraulic pipeline transport there is an intensive washout of alkaline metals from the coal. As a result of removing the salts and transferring them to the water the nature and process of the slurry movement is altered.

Special research was conducted at test facilities on pipe 104 and 202 mm in diameter to estimate the transport parameters and specify the mathematical functions for determining them. Used as the transported material was coal 0-3 and 0-13 mm in size from the Novomoskovskiy field (Western Donbas), which contains up to 1.2 percent of alkaline metals, and as the transport vehicle -- fresh water and mineralized mine water containing up to 10 g/l of sodium chloride. It was established that the velocity of movement of the slurries when transporting coal in a weak sodium chloride solution was reduced an average of 15 percent, and unit losses by 10 percent, relative to the parameters for movement through pipelines for coal of the same density and size in fresh water. To prevent the occurrence in pipelines of viscous flow marked by high energy losses, the initial content of particles of 0.074 mm in coal 0-3 mm in grade should not exceed 17 percent, and the initial mineral content of the transporting medium should not exceed 7 g/l of sodium chloride.

Analysis and mathematical treatment of the data obtained demonstrate that, when transporting slurries consisting of coal with a high content of alkaline metals and mine water, to establish the basic parameters of hydraulic transport one can use the well known equations (1) that define unit losses of pressure, and functions (2) for calculating the critical velocities for introducing empirical factors and adjusting them on the basis of experience. The following functions yield the closest convergence to the experimental data:  
when transporting coal of size 0-13 and 0-25 mm

$$u_k = k_d \sqrt[3]{\frac{\rho}{\rho_0}} \sqrt{gD(1+\gamma S)}, \quad (1)$$

$$i_c = i_0 + k_d D f \gamma S, \quad (2)$$

when transporting coal of size 0-3 mm

$$u_k = k_{sp} \sqrt[3]{\frac{\rho}{\rho_0}} \sqrt{gD(1+\gamma S)}, \quad (3)$$

$$i_c = i_0 + k_{\gamma} D f \gamma S, \quad (4)$$

where  $u_k$  is the critical velocity of slurry movement;  
 $k'_d$  is an empirical factor that takes account of the weighted mean size of a transported material in a high-density medium;  
 $\rho$  and  $\rho_0$  are the density of the coal and of the transporting medium;  
 $D$  is the diameter of the pipe;  
 $\gamma$  is the relative density of the solid matter;  
 $S$  is the volume-part concentration of the slurry;  
 $i_c$  and  $i_0$  are the unit losses of pressure during movement of the slurry and the transporting medium;  
 $k_{dD}$  is an empirical factor that takes account of the effect of pipe diameter for a given range of size of the transported material and the density of the transporting medium;  
 $f$  is the theoretical friction factor, equal to 0.2-0.35;  
 $k_{sD}$  is an empirical factor that takes account of the effect of slurry concentration and the increased density of the transporting medium;  
 $k_{\gamma D}$  is an empirical factor that takes account of the effect of pipe diameter and density of the transporting medium.  
The empirical factors  $k'$  and  $k_{dD}$  are found from the equations:

where  $d_c$  is the weighted mean diameter of the transported coal, in mm. The values of the factors  $k_{\gamma D}$  and  $k_{sD}$  are shown in Tables 1 and 2.

Table 1.

| $D, \text{ mm}$ | 100   | 150   | 200   | 250   | 300   | 350   | 400   |
|-----------------|-------|-------|-------|-------|-------|-------|-------|
| $k_{\gamma D}$  | 0,340 | 0,180 | 0,120 | 0,104 | 0,100 | 0,098 | 0,094 |

Table 2.

| $S, \%$  | 5    | 10   | 15   | 20   | 25   | 30   | 35   | 40   | 45   |      |
|----------|------|------|------|------|------|------|------|------|------|------|
| $k_{sp}$ | 0,77 | 0,92 | 0,98 | 1,00 | 0,97 | 0,94 | 0,90 | 0,88 | 0,87 | 0,86 |

Thus, as a result of research, specific factors have been supplied for the functions defining the critical velocities and unit losses of pressure for the hydraulic transport of coal with a high content of alkaline metals. The coefficient of variation of the design and experimental values of the basic parameters of hydraulic transport do not exceed nine percent.

The parameters obtained offer a more efficient transport procedure and eliminate the possibility of having the slurry turn into a viscous medium. If these

parameters are large, there is a considerable limitation in the distance to which coal with a high content of alkaline metals can be transported.

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## COAL

### KIRGHIZ COAL OUTPUT FAILURES, PROSPECTS

Frunze SOVETSKAYA KIRGIZIYA in Russian 12 Sep 85 p 2

[Article by I. Gorodnyanskiy, chief of the inspectorate for the control of the utilization and conservation of mineral resources of the Kirghiz SSR Gosgortekhnadzor under the "Through the Course of Accelerating Scientific-Technical Progress" rubric: "Reconstruction of the Mines: Correct Method of Putting the Extraction of Coal on the Track of Intensification"; first three paragraphs are SOVETSKAYA KIRGIZIYA introduction]

[Excerpts] In its coal reserves, Kirghizia holds fourth place in the country, being behind only the RSFSR, the Ukraine and Kazakhstan. Unfortunately, a decline has recently been observed in the rate of the extraction of fuel in this very old sector of the republic's industry. The tasks of the 9th and 10th five-year plans were not fulfilled. And it will be difficult to fulfill the 11th Five-Year Plan.

The volumes of fuel extracted began to lag behind the growing requirements of the Kirghiz national economy and the entire Central Asian region.

How can the situation in the sector be corrected? Several articles--the first of which is published today--are dedicated to this question.

What is the essence of the problem? Why is coal extraction declining in the republic?

Let us initially make it clear to ourselves that the principal deposits of Kirghizia are favorable precisely for development using the underground method. It is therefore no accident that the main coal regions Kyzyl-Kiya, Tash-Kumyp, Kok-Yankak and Sulyukta were historically established as underground mining regions.

It would seem that all of this should have been utilized prudently, giving preference to the underground method of work, perhaps not the most profitable but rather well assimilated. In 1984, in fact, underground extraction amounted to only 38 percent of overall realized output. This happened because not once were old mines reconstructed in the republic, even though many have been in operation since the prewar years. New galleries were consistently opened up and prepared using local inclined fields. In the final analysis,

the transport and ventilation systems became so complex that the extraction of coal is becoming not only unprofitable but very difficult both in the technical as well as the organizational sense. Especially instructive in this connection is the situation at the 2/4 mine of the Sulyukta Mine Administration. The striving to resolve the problem of extraction by taking the easy way without a fundamental restructuring of the mining operations and without capital investments led to the question of the closing of the mine. Meanwhile, its remaining reserves taking into consideration a reserve field amount to more than 12 million tons, that is, enough to provide work for many years.

The first conclusion from what has been said is that it is essential to reconstruct the operating mines. This will make it possible to put the underground method of fuel extraction on the track of intensification, especially since reconstruction does not require significant initial capital investments and the yield, the increase in production capacities can be achieved in a relatively short time. The resolution of this task is within the competence of Gosplan, the planning institutes and the enterprises of the republic directly.

Further, the sites of all Kirghiz coal deposits are very complex in their geological mining conditions. It is difficult, for example, to find analogies in our country to the Kok-Yankak Deposit, which is broken by many hundreds of tectonic fractures, whereby the faults often have considerable amplitude. This means that it is essential to have a new mobile technology for preparing and developing plans and special tunneling and excavation equipment is needed.

At the Kok-Yankak Mine, for example, they are now attempting to bring in huge, power-consuming and expensive OKP [ridger for rocky soils] and KM [reclamative trench digger] complexes (these complexes are produced by the plants mainly for the country's coal basins with quiescent occurrences of reserves) for small extraction fields. Is it any wonder that they work unprofitably and that the load on them is far from comparable with the indicators of other basins? In addition, the utilization of such equipment leads to a reduction in the extraction of coal. Thus, whereas 700,000 tons were mined at the Kok-Yankak Mine in 1976 without complexes, it was only 500,000 tons in 1984.

The absence of mobile technology for the extraction of broken strata at the Kok-Yankak Mine and the use of equipment that does not meet the geological conditions of the occurrence of the strata led to a menacing amount of deterioration and overestimation of confirmed balance reserves here. Those of them that can be worked with the use of the existing mechanized complexes are considered to be industrial and the others are categorically discarded.

Here are some figures confirming this. In 1976, that is, at the beginning of the introduction of the mechanized complexes, the balance reserves within the technical limits of the mine amounted to 84 million tons but they declined to 43 million tons by 1979. This process of reduction and deterioration of balance reserves is still continuing. Gosgortekhnadzor and the Kirghiz SSR Administration of Geology are taking measures to end this process but without due success.

In the development and introduction of mobile technology for the complex geological conditions at the sites of the Kirghiz coal deposits, special attention should be paid to the establishment of flexible technology for the working of steep strata, whose reserves account for a significant percentage in the republic's overall balance of deposits. The fact is that the western parts of the fields of the mines imeni Leninist Komsomol of the Kyzyl-kiya Mine Administration, the 6/18 mines of the Sulyukta Mine Administration, and the high-quality coals of the Dzhergalan Mine were not worked for a long time precisely because of the absence of this technology.

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COAL

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LABOR MANAGEMENT COMPLAINT SENT TO UKRAINIAN COAL MINISTER

Kiev PRAVDA UKRAINY in Russian 24 Sep 85 p 2

[Article by A. Kirichenko, leader of the integrated brigade of section No 6 and member of the CPSU, and V. Cherun, link leader in section No 1 and member of the CPSU; Komsomolets Donbass Pit of the Shaterskantratsit Association: "Enough Backwardness! Open Letter to Ukrainian SSR Coal Minister N.K. Grinko"]

[Text] Dear Nikolay Konstaninovich! Great anguish and concern about the fate of the Komsomolets Donbass pit, where we work, has prompted us to turn to you through the newspaper PRAVDA UKRAINY.

As you know, the pit went into operation at the end of 1980, a year ahead of schedule. This was a great victory for mining engineers. At that time, our collective also gave its word to reduce by 1 year the period specified for reaching the planned capacity of the enterprise.

During the festivities that took place at that time, it was noted that our pit is one of the largest and most up-to-date in the sector, that it is capable of producing 7,000 tons or more of fuel daily. It was said that our productivity per worker will amount to more than 100 tons of coal per month, two or three times greater than the existing output at a number of enterprises already in operation. The high degree of mechanization and automation of the coal mining processes was stressed. In short, in their speeches, the scientists, planners and workers of the Ukrainian SSR Ministry of the Coal Industry promised our pit a great future.

As time made evident, however, these were only pleasant hopes. Things were going very badly with us.

On the threshold of 1986, determined by the collective as the date of the early mastering of the planned capacity of the pit, we are extracting about 5,000 tons of coal daily instead of 7,000. Since the start of the five-year plan, we have fallen behind by more than 400,000 tons of fuel, and labor productivity amounts to only 34.9 tons per month. The tunneling is not going so well either. Whereas the plan calls for 100 meters, the average monthly rates of progress of preparatory work amount to no more than 70 meters. As a result, there is always a lack of space in the working line of the face.

Overall, as you can see, we are failing to meet any of the indicators of the five-year plan. It could be worse but not much, as they say.

In this letter, we will not touch on the objective factors that are in our way. They are not the ones preventing us from working at full efficiency, in the Stakhanovite manner. We are indignant about the faulty style of management, which the workers of your ministry and the association demonstrate whenever they visit the pit. And they relate irresponsibly even to your instructions.

We remember, Nikolay Konstantinovich, that you came to our pit in April of this year. You conferred with workers at various levels, asking why the collective is working so poorly. Various reasons were named. Among them were noted the incorrect utilization of tunneling equipment, the poor quality of its performance, and the low qualifications of machine operators. At that time, you recommended that we make use of company servicing of tunneling equipment by entering into a contract with the Yasinovatskiy Machine Building Plant, on the basis of which the pit would receive continuous help in adjusting the delivered tunneling combines and in acquiring the spare parts and components that they need. In addition, you obliged A.I. Zakharchenko, chief of the ministry's power machine administration to help in introducing this progressive system of technical servicing at Komsomolets Donbass. And what happened? It turned out to be a good decision on paper only. If only it were the only one. How many "paper" decisions have already been made, how many commissions at various levels have visited us on account of our backwardness, how many times have we heard promises to help and to debug.... It is honey on their lips but in reality it is more bitter than pepper.

In August of last year, a sizable group of specialists came to the pit. The group included V. V. Tarasenko, deputy chief of the ministry's technical administration; B. S. Shor, a leading specialist of this administration; Ye. T. Proyavkin, first deputy director of the DonUGI Institute for Scientific Work; Yu. G. Spitsyn, division chief; V. Ye. Zhukov, laboratory head of this institute; and specialists from the Shakhterskantratsit Association. They came with the important objective of determining the reasons for the unsatisfactory work of the collective.

And what did they find out in their 2 days at the pit? They recognized the unsuitability of the work of the KMS-97DN complex under conditions unacceptable for it in one of the longwalls. That is, they confirmed the long-held opinion of the pit specialists. May I say, dear Nikolay Konstantinovich, that they presented these results of the check in a report in your name. Whereby you must know that the report was prepared by our head process engineer S. A. Shcherbak, whom the commission called to the DonUGI Institute for this purpose immediately after its departure. For almost a week, they tore the specialist away from urgent work in the pit.

Is this really the official approach to the resolution of enterprise problems? How long can one merely go through the motions, creating the impression of activity? Where is the party conscience of your examiners? Is this really the work to which the party is calling us?

And right now a commission (there have been so many!) from the ministry is with us. It includes seven specialists headed by V.N. Ostapenko, deputy chief of the technical administration. They are checking whether the longwalls have been prepared properly and if the standards are correct for the working and preparatory faces, etc. What is the reason for all this? We do not know. And we no longer believe the commissions that have literally overwhelmed the pit. Believe it or not, every day we have 10 to 15 examiners from the most varied levels of the sector--from the Shakhterskantratsit Association, the territorial committee of the trade union, the coal institutes, the Ukrainian Republic Committee of the Trade Union of Coal Industry Workers, Gosgortekhnadzor, the staff of the Ukrainian SSR Ministry of the Coal Industry.... And each commission, instead of giving specific help, produces worthless paper, and distracts the pit managers and a large number of engineering and technical workers from their immediate duties. And no one wants to hear about what is really needed. For what we need to do above all is to carry out a fundamental reconstruction of underground transport and resolve the prolonged question of the removal of rock from the 628-meter level. Right now these are the worst "bottlenecks" at the enterprise.

And how the collective is unnerved by the instability of the plans! Is it really so difficult for the specialists of the Shakhterskantratsit Association and the ministry to establish for each longwall an optimum, firm and scientifically valid productivity plan for the day, month and year? In sections Nos 1 and 6 where we work, for example, there was no month this year when they did not change the plans for the extraction of fuel. The situation is the same in the rest of the sections. This makes the people discontented and causes them to lose interest and faith in tomorrow.

And there is another very burning question for our collective. As it appears to us, the stability of the mining collective depends entirely upon the proper choice of the managing personnel. And what do we have? The pit has been headed by three directors since it went into operation. And there have been three chief engineers. We are ashamed to speak of the turnover of section chiefs. During this time in the fifth section, for example, there have been...16 managers. And in the remaining extraction sections, the managing link was changed an average of three or four times during the last 4 years. The question arises, what kind of personnel policy is this?

Especially surprising is the choice of pit directors. After all, to manage coal production primarily involves the management of people. And how could Yu.K. Koval manage a collective of many thousands of people when he is an ignoble person in addition to being fond of alcoholic drinks? That is why he stayed with us only 8 months. His replacement, V.D. Baranovskiy, did not encourage the workers to resolve questions independently. He imposed his own will on them, underestimated the role of specialists and social organizations, and had only a vague idea of the prospects for the enterprise. After 2 years, Baranovskiy, who could not work with people, was freed from the work on the recommendation of the party obkom.

We now have a new director--A.G. Ped. What can be said about him? He does not, as they say, seek to make it easy on himself and he is not afraid of hard

work. At the same time, however, he thinks more about tons and meters and is not as concerned about people as one would like. If you come to him about a production or personal matter on a day when he is not receiving visitors, the secretary will not let you see him, saying: "The director is not in, he is at the association."

In reality, however, he is sitting...in his office. This has happened more than once. He ought to go more often where the work is assigned and not neglect to give a friendly word of thanks to some collective or another that has overfulfilled the shift task.

To find and train a worthy manager for a large coal enterprise is only part of extensive and important work. One must also check his work on a daily basis and help him, not by reprimanding him at conferences in the association or ministry and not through all sorts of visiting commissions but through specific action. Do all those in the Ukrainian SSR Ministry of the Coal Industry always understand that words and deeds must be unified and weighty?

In the name of the entire collective of the Komsomolets Donbass pit, we want you, dear minister, to answer us: Are we going to continue for long to lag behind because of people who do not want to work in the new way, in the spirit of those demands put forth by the April (1985) CPSU Central Committee Plenum?

The state plan is the law in our country. And when it is not fulfilled, the worker's conscience cannot rest easy nor especially the conscience of the communist and manager invested with the authority and confidence of the people. That is how our own party puts the question. And rightly so.

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COAL

BRIEFS

YUZHNIY DONBASS MINE--Donetsk, 6 Nov--Donetsk miners and builders achieved a great victory during their pre-October duty shift. Today the main new construction project of the basin, the Yuzhnodonbasskaya Mine No 3, was put into operation. Its planned capacity is 2,400,000 tons of coal annually. The giant enterprise will double the capacity of Yuzhniy Donbass, the youngest industrial region of the oblast, which will provide the metallurgical plants of Donetsk and Zhanov with coking coal. In utilizing the progressive organization of labor and industrial methods of construction, a detachment of mine builders completed the project at an overtaking pace. A ferroconcrete headframe as high as a 40-story house was set up on artificially frozen ground, which reduced by an entire year the time for its construction and the tunneling of a shaft under it. The provision of the construction site with mobile equipment brought in from the plant in consolidated units saved a lot of time. [By N. Stolyarov] [Text] [Kiev RABOCHAYA GAZETA in Russian 7 Nov 85 p 1] 9746

DONETSK MINERS FULFILL PLAN--The miners of Donetsk reported the fulfillment of the five-year plan for coal mining. Behind this is considerable intense work of a collective of many thousands. During 4 years and 9 months, 100 million tons of coal were extracted and sent to consumers, of which 4.8 million tons were in excess of the established plan. The target for the increase in labor productivity was overfulfilled by 2.3 percent. By reducing the production cost of fuel, 26 million rubles were saved. Today the collectives of 8 mines and mine administrations and 150 extraction and tunneling brigades are working on the account of the 12th Five-Year Plan. [By G. Dorofeyev] [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Oct 85 p 1] 9746

EKIBASTUZ COAL MINING--Pavlodar Oblast--A triumphal event has occurred in the Ekibastuzugol Association. The miners of the "fourth All-Union stokehole [coal field]" extracted and shipped the billionth ton of Ekibastuz coal ahead of schedule. IZBESTIYA reported on this briefly in issue No 338. Now for the details. On 24 December 1954, the first trainload of coal was sent to the Urals from the cold and inhospitable steppe of Kazakhstan. The Ekibastuz Association began to pick up this pace with the start-up of the Bogatyr open pit--the largest in the world--where they mined the 800-millionth, 900-millionth, and now the billionth ton of inexpensive Ekibastuz coal. Having achieved the planned capacity in 1983, today the pit is yielding considerable more than was specified. The recent start-up of the first phase of the new

highly mechanized Vostochniy open pit has brought success closer. [By V. Shchepotkin] [Excerpts] [Moscow IZVESTIYA in Russian 7 Dec 85 p 1] 9746

**NEW EXCAVATOR**--The brigade of Vitaliy Milentyev set up a giant new excavator at the Angren open coal pit ahead of schedule. The mark of the giant machine manufactured by the Izhor machine builders is EKG-15. This means that the capacity of its bucket is 15 cubic meters. Not merely a little "zhiguli" but a whole truck can easily drive into such a bucket. In one pass, the excavator can take out a layer of earth as high as a five-story house. The Angren coal miners were the first in the country to receive such a machine; its plant number is 1. It therefore required the entire experience, mastery, and working ingenuity of Milentyev's brigade to set up the excavator successfully. One can judge what was involved merely from the fact that two cranes, one with a lifting capacity of 25 tons and one of 125 tons, were required in its assembly. Viktor Yezhkov, one of the most experienced machine operators at the pit, actively helped the assemblers. He and his brigade will work with the giant machine. He and his comrades are now involved in adjusting it. Technical reequipment is one of the main directions in the reconstruction of the Angren open pit. New machines will make it possible to triple the annual extraction of fuel to 15 million tons with practically the same number of workers. [Text] [Tashkent PRAVDA VOSTOKA in Russian 12 Sep 85 p 1] 9746

**VORGASHOR MINE**--Vorkuta, 15 Dec--Since the beginning of the year, the miners of the seventh section of the Vorgashor Mine extracted 1 million tons of coal. It is the first time that they have achieved this result. The section previously worked unevenly. Yu. Berezovskiy, mining engineer and member of the party committee, and mechanic V. Radchenko were put in charge of it. They were able to unite the collective in a short time. The daily extraction of coal here increased by more than 3,000 tons. [Text] [Moscow PRAVDA 15 Dec 85 p 1] 9746

**ANNUAL FUEL PLAN FULFILLED**--Donetsk--The brigade of the workers of the breakage face, led by Hero of Socialist Labor P. Negrutsey, was the first at the mine imeni Zasyadko to fulfill the annual plan for the extraction of fuel. This year, the right-flank collective of the shock labor shift in honor of the 27th CPSU Congress shipped to consumers more than half a million tons of coal. Outstanding combine machine operators included A. Gerasimov, G. Dorofeyev, and experienced miners I. Anisenko, V. Lutsevov, and Yu. Novikov. The miners are utilizing the automated coal mining complex KM-87 UMA efficiently, are organizing labor precisely, and have reliable engineering. As a result, labor productivity increased by 13 percent, the production cost of the extracted fuel was reduced by 1.7 percent, and almost 23,000 rubles were saved. The leading brigade obligated itself to increase the above-plan account of coal mined to 100,000 tons by the end of the year. [By M. Gusev] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 12 Nov 85 p 1] 9746

**ANNUAL ANTHRACITE PLAN FULFILLED**--Rostov-na-Donu--The brigade of Vyacheslav Kuzmenkov from the mine imeni 60-Letiye Leninskiy Komsomol was the first on the coal Don to fulfill the annual plan. It brought up 407,000 tons of anthracite. The miners achieved this success through the competent utilization of machinery and equipment. The brigade was the first in the Gukovugol Production Association to use two extraction combines in the

longwall and attained the record indicator of labor productivity of 563 tons of coals monthly per miner. The average daily load per longwall was almost double the planned load. The advanced collective has already worked 3 days using economized materials and has reduced the production cost per ton of coal by 21 percent. [By SOTSIALISTICHESKAYA INDUSTRIYA correspondent V. Uzhakin] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 23 Aug 85 p 1] 9746

VOSTOCHNYY OPEN PIT--The deed of transfer to operation has been signed for the first phase of the Vostochnyy open coal pit in the Ekibastuz Fuel and Power Complex. Four efficient complexes for the open mining of coal were combined here into one industrial chain: extraction using rotary excavators, conveyor transport, neutralization of fuel of varying ash content, and precise dosing when loading into cars. The capacity of the first phase is 7.5 million tons of power fuel. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44 Oct 85 p 23] 9746

WATER REMOVAL SYSTEM--Donetsk--A new system proposed by the scientists of the Donetsk Polytechnic Institute for the removal of water from the mine face makes it possible to free miners from extrinsic work and to reduce coal losses. The installation developed at the BUZ continuously removes solid matter from the water in the mine. With the help of machinery, it is put into mine cars. Through this method, they obtain an additional several carloads of fuel daily. The machine unit of the polytechnic scientists has already successfully gone through production testing. It is planned in the next five-year plan to equip 30 Donbass mines with the new efficient water-removing installations. [Text] [Moscow SELSKAYA ZHIZN in Russian 3 Nov 85 p 1] 9746

COAL HEADFRAME--Krasnodon (Voroshilovgrad Oblast)--The assemblers of the Voroshilovgradshakhtostroyontazh Trust performed a complex engineering operation in the reconstruction of the mine imeni 50-Letiye SSSR of the Krasnodonugol Association. Simultaneously with the tunneling and reinforcement of the vertical shaft of a new gallery, they set up a coal headframe, a complex mine engineering structure, and then they "moved" it onto its foundation. The application of this method of erecting the headframe accelerated its introduction into operation by 8 months. [Text] [Moscow TRUD in Russian 5 Dec 85 p 1] 9746

KUZEMBAYEV MINE--Karaganda--The collective of the mine imeni Kuzembayev has again begun to produce coking coal. The introduction of progressive technology is contributing to this. Developed by the enterprise innovators, it made it possible to bring the so-called block strata of coal into production. As a result, the enterprise has already shipped more than 400,000 tons of solid fuel above the plan. [Text] [Moscow SELSKAYA ZHIZN in Russian 10 Nov 85 p 1] 9746

NEW BROWN COAL DEPOSIT--Karaganda--Just 2 years ago, hardly anyone knew the name of Lake Shubarkol. Everything has changed since geologists came to its shore. Here they found a deposit of high-quality brown coal suitable for development using the open method. Recently they began to put in a main railroad line and highway to Shubarkol and power transmission poles approached the deposit. Stripping work is in full swing and housing is being constructed. In the future, a mining town will grow up in the "deep place."

As early as next year, an experimental open pit at Shubarkol will yield half a million tons and a year later 1 million tons of coal. [By SOTSIALISTICHESKAYA INDUSTRIYA correspondent G. Belotserkovskiy] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 14 Sep 85 p 2] 9746

NEW OPEN PIT--Uzgen, 19 Oct--A new open pit in the republic--Kum-Bel--has yielded the first tons of high-quality coal. The fuel is going to kolkhozes, sovkhozes and to industrial enterprises of Uzgenskiy, Sovetskiy, Kara-Suyskiy and other rayons of Osh Oblast. With no additional prospecting of the reserves of the deposit, Kum-Bel can be worked through the year 2000. It will provide consumers with up to half a million tons of coal annually. The utilization of local resources will permit the reduction of the importation of fuel from other regions of the country. [By N. Pletnev] [Text] [Frunze SOVETSKAYA KIRGIZIYA in Russian 20 Oct 85 p 1] 9746

NEW OPERATIONAL CAPACITIES--The Yubileynaya Mine in Novokuznetsk was put into operation ahead of schedule, in June instead of December. Berezhovskiy-1, one of the open coal pits of the Kansk-Achinskiy Fuel and Power Complex, is increasing its capacities. The capacity of its first phase is 4.5 million tons. The flow of the power fuel of the Vostochnyy open pit in the Ekibastuz Fuel and Power Complex is being expanded. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44, Oct 85 p 23] 9746

ANTHRACITE PRODUCTION--Rostov-na-Donu--The collective of the brigade of miners of the working face Yuriy Maksimov of the mine imeni 50-Letiye Oktyabr of the Gukovugol Production Association is providing an example of the highly efficient utilization of coal-mining equipment as well as of organization and discipline. The brigade yields up to 120,000 tons of anthracite monthly. The average monthly load on the longwall reached 3,800 tons and labor productivity reached 600 tons of coal monthly per worker. The miners met the annual obligation more than 3 months ahead of schedule, producing 1 million tons of anthracite. Since the beginning of the five-year plan, the leading collective extracted a total of 5,317,000 tons of coal. [By SOTSIALISTICHESKAYA INDUSTRIYA correspondent V. Uzhakin] [Excerpts] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Sep 85 p 1] 9746

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NUCLEAR POWER

RECENT DEVELOPMENTS AT VOLGODONSK ATOMMASH PLANT

SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE, No 32 (344)

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 8 Aug 85 p 2

[Article: "Counting on Initiative"]

[Text] That was the title of an article by V. Kazakov, party committee secretary of the Volgodonskenergostroy Trust, published in No 32 (344) of SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE. For the collective erecting the Volgodonsk power production complex, the approaching holiday--Builder's Day--is something special, writes the author. The detachment of thousands of builders of the Volgodonskenergostroy Trust is celebrating its tenth anniversary. Much was done during this time. Operations producing reactor equipment putting out 4 million kilowatts were built and placed into operation at Atomash, all of the plant's main production buildings are in operation, and they are manufacturing their products.

K. Kondratov's carpenters' brigade from Otdelstroy is working on its quotas for November of next year. What is the secret behind the collective's successes? This question is answered by Z. Bulgakov, senior engineer of the standards research station, in his article "In Step with Time."

This issue also carries the article "At the Level of Inventions" by G. Lyashkova, the leader of the new equipment, inventions, efficiency work and information group of Volgodonskenergostroy, the article "Calculations and Realities" by V. Kuropyatnik, brigade leader in the Volgodonsk Kavelektromontazh Administration, and the article "In Behalf of Proficiency and Broad Dissemination" by A. Knyazev, chairman of the city sports committee.

Kuzma Volgodonskiy acquaints readers with his humorous piece "Clean Work."

SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE, No 35 (347)

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 30 Aug 85 p 2

[Article: "Faithful to Tradition"]

[Text] One of the important objects of Atomash is building No 4. This year two initial projects within the complex are to be placed into operation.

28 March 1986

Having initiated a broad socialist competition in honor of a noteworthy date--the 50th anniversary of the beginning of the Stakhanov movement--the builders pledged to place two heating furnaces into operation ahead of schedule. As A. Zornin communicates in a report titled "Faithful to Traditions" published in No 35 (347) of SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE, pledges are being fulfilled successfully and the machine units are being installed ahead of schedule.

An evaporator being produced at Atom mash was awarded the top quality category by decision of the state certification commission. This success of the plant is described in the article "One More Pentagon" by T. Makarov.

The plant and scientific progress, and further improvement of production: These are the topics that are of present concern to each employee of Atom mash. The newspaper's editorial board prepared a survey dealing with scientific-technical progress in the enterprise. In an article titled "Thinking About Tomorrow" published in this issue, Atom mash chief welder V. Molchanov answers the questions.

The newspaper also carries the articles "The Green Detail of Volgodonsk" by A. Kalashnikov, chief of the production group of the city executive committee's chief architect's administration, and "A Turn Toward the New" by G. Obukhov.

This issue contains another edition of the "Youth Orbits" describing the works, plans, personal life and leisure of young builders and operators at Atom mash.

SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE, No 36 (348)

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 5 Sep 85 p 2

[Article: "Higher Production Effectiveness"]

[Text] This is the title of an article in SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE, No 36 (348) describing the pledges adopted by the collective of the Atom mash Production Association concerned with accelerating scientific-technical progress. A decision was made to complete the current year's plan for the principal technical-economic indicators ahead of schedule. The socialist pledges also foresee exceeding the 12th Five-Year Plan's quota for product sales, established by the control figures, by 10 million rubles.

Adopting the high socialist pledges, the Atom mash collective is requesting that they be included in the state plan for the next five-year plan, and it promises that it will fulfill this plan with honor.

This issue also carries the articles "The Price of a Diploma" by D. Kamenev, chief of the design bureau of instrument production at Atom mash, "Without Changes for the Better" by O. Volkov, deputy chief of the housing construction combine, and the report "'Difficult' Adolescents" by A. Zornin.

Kuzma Volgodonskiy acquaints readers with the humorous piece "Competitive Examinations."

SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE, No 37 (349)

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 12 Sep 85 p 2

[Article: "At the Finish Line"]

[Text] This year the collective of the Volgodonskenergostroy Trust is working better than before on facilities of Atom mash. New summits were also conquered by the plant's workers, who are basically meeting the planned indicators. But are the builders and operators of Atom mash doing everything they can to pay back their debts in the time remaining before the end of the five-year plan, to fulfill the five-year assignment and to greet the 27th CPSU Congress with substantial successes in labor? The lead article "A Shock Pace at the Finish of the Five-Year Plan" of the current issue No 37 (349) of SOTSIALISTICHESKAYA INDUSTRIYA NA ATOMMASHE is devoted to this question.

In a report titled "A Businesslike Approach" A. Bogozov, a lift truck mechanic from the central mechanical repair shop of the concrete slurry plant, tells the reader how a recent party election meeting assisted in solution of important problems in the collective's life.

"Introduction is the most important thing," believes V. Kostenich, director of the Volgodonsk affiliate of the VPKTI [All Union Draft-Design and Technological Institute] of the Atomkotelomash Scientific-Production Association, who responds to questions in a survey concerned with the problems of accelerating scientific-technical progress at Atom mash.

The details of the events in Volgodonsk during SOTSIALISTICHESKAYA INDUSTRIYA Day are described in the department "Newspaper--Reader: Strengthening Contacts."

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CSO: 1822/41

NUCLEAR POWER

PROGRESS REPORT ON AZERBAYDZHANSKAYA AES CONSTRUCTION

Baku BAKINSKIY RABOCHIY in Russian 21 Sep 85 p 3

[Interview with R. A. Gamidov, Azenerghostroy Trust Administrator by P. Savin:  
"Azerbaydzhanskaya Atomic"; date and place not specified]

[Excerpts] A new construction and installation administration  
has been created for the Azerbaydzhanskaya AES by the Azenerghostroy Trust.

"This is a great honor and a great responsibility," stressed the trust's administrator, Rasul Akhmedovich Gamidov. "And we will apply all effort to erect the republic's first nuclear power plant on time."

[Question] Please briefly describe the characteristics of the nuclear power plant.

[Answer] The nuclear power plant will consist of four individual power production units with a capacity of a million kilowatts each. Let me say for comparison that the capacity of all power production units of the Azerbaydzhanskaya GRES, the largest in the republic, is 1.2 million kilowatts.

Each production unit of the AES will essentially be an independent nuclear power plant together with all of the associated equipment--a reactor, a steam generator, pumps, a turbine and so on. Preference is being given to the single-unit principle on the basis of its high economic indicators and technical characteristics on one hand and with regard for insuring the safety of people and protecting the environment on the other.

Finally, also of no small importance is the fact that erection and placement of the units into operation one after the other will make it possible to organize flow line construction, achieve clear specialization of construction and installation operations, and use standardized load-bearing and enclosing structures. In other words this will make it possible to accelerate and cheapen construction without the slightest detriment to quality.

Despite the fact that the AES is a basically new facility for us, we have no intention of reinventing the bicycle, as they say. Guiding ourselves by the directives of the April and July (1985) CPSU Central Committee plenums, we are striving to achieve the fastest possible return from every ruble invested by the state. It is with this purpose that many of our workers, especially those of the new construction and installation administration of the Azerbaydzhanskaya AES, which has been placed under the direction of Ilyas Mukhtarov, an

experienced builder in power engineering, visited the Kalininskaya, Zaporozhskaya, Chernobylskaya, Krymskaya, Yuzhnoukrainskaya, Balakovskaya and other nuclear power plants. In those places, people shared their secrets with us. And the positive experience we accumulated will doubtlessly help us solve many problems.

[Question] Is this not a typical trait of the Soviet way of life?

[Answer] Of course. I can say with deep conviction that every construction project is a clear example of the internationalism of the Soviet people--in action, so to speak.

Take our atomic power plant as an example. Engineers of the Rostov department of Atomteploeletkroproyekt, our general designer, made an enormous contribution to its planning. Associates of the Atomenergostroyproyekt (Kiev), Energozhilindustrproyekt (Volzhskiy), Azgosproyekt (Baku) and other design organizations have done a great deal and are continuing to do so. Our orders are being placed with dozens of enterprises. Many specialized construction and installation subdivisions of the country will be completing certain jobs. Our actions have been coordinated with theirs, and this should insure final success.

[Question] And is everything proceeding smoothly?

[Answer] There are, of course, difficulties as well. Today for example, we are concerned by some delays in delivery of the planning estimates. Only 60-70 percent of the planning estimates have been written up for certain priority projects. Let me take this occasion to ask the planners, by way of the newspaper, to intensify their attention toward these estimates. After all, time does not stand still.

[Question] Incidentally, what is the construction schedule?

[Answer] The first power production unit is to be placed into operation in 1993. The fourth and last will produce energy in 1999. Thus construction of the AES will proceed for a long time.

Preparations outside the construction area will be completed by 1988. By this time a large volume of the work will be completed. The next 5 years will entail preparations within the construction site. This period will overlap somewhat with the main period as well (with completion of the first power production unit). The main period will then extend until the end of construction.

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## NUCLEAR POWER

### PROGRESS REPORT ON SOVIET PARTICIPATION AT KOZLODUY AES

Moscow PRAVDA in Russian 17 Sep 85 p 4

[Article by corres. L. Zhmyrev, Sofiya: "With the Energy of the Peaceful Atom"]

[Excerpts] Things are hot at the Kozloduy Atomic Power Plant now. And not only because the summer was hotter than ever, and because the mercury column climbed to records heights. The construction project has entered its final and most intensive stage. The fight for timely commissioning of the first million kilowatt power production unit in the CEMA countries (outside the USSR) has reached its apogee.

The progress of construction may be likened to decorating a giant Christmas tree. Just the weight of the various "ornaments" installed at the different facilities was measured in the hundreds of tons. The fully prefabricated dome of the reactor room, which weighs a total of 320 tons, was recently raised from the ground and installed on the supporting ring. With this operation, which has no equals in the practice of nuclear power plant construction, the top of the sealed zone of the million kilowatt reactor room was completed.

The largest detachment of Soviet specialists on the territory of Bulgaria is participating in the erection of the million kilowatt power production unit. They came here from the Zaporozhskaya, Balakovskaya, Kalininskaya, Yuzhno-Ukrainskaya and other Soviet nuclear power plants, and from the USSR's largest design organizations. The reactor was manufactured in Leningrad, the turbine unit was built in Kharkov, and equipment is also coming in from Tbilisi, Novosibirsk, Cheboksary, Tashkent, Belgorod, Tallinn and other USSR cities. The packing crates also bear the addresses of plants in East Germany, Poland, Czechoslovakia, Romania and Yugoslavia. And even the Bulgarians themselves are making a tangible contribution to international socialist division of labor in nuclear power engineering. Various structures are being sent to Kozloduy from Radomir and Ruse, and biological protection equipment, special pumps and so on are being delivered from Pleven.

It would seem that because the power production blocks in Kozloduy are being erected one after the other, current work at the power plant must be a repetition of work done previously. But things are not in fact all that simple, says I. Sapir, leader of the group of Soviet specialists at the nuclear power plant. The million-kilowatt power production unit differs significantly from the units previously placed into operation in view of a higher technical level

of execution and a number of supplementary requirements imposed on radiation safety and seismic stability. Moreover the work is proceeding by the method of parallel design and construction. A significant proportion of the equipment coming from the USSR and other CEMA countries has not yet been tested in operation. In a number of cases this makes it necessary to change the blueprints locally on the basis of experience in erecting similar nuclear power plants in the USSR, and to proceed with installation not according to a template but rather on the basis of the actual conditions in each specific case. Need we mention the great responsibility laid in this case upon Soviet specialists who are providing assistance in all stages of construction?

And so, the fifth power production unit is beginning to take final shape. But what comes after? Another million-kilowatt unit will be erected. It will be located next door to the fifth. The excavations have already been completed, and the foundation of the unit's turbine house is being poured at full speed. But that is not all. East of Kozloduy, also on the bank of the Danube, erection of Bulgaria's second nuclear power plant has been started in a place called Belene. When it becomes operational, the electric energy obtained here from the power of the peaceful atom will represent 60 percent of the total volume of such power produced in Bulgaria.

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## NUCLEAR POWER

### BRIEFS

**BILIBINSKAYA ATETs**--The Bilibinskaya ATETs consists of four identical power production units. The main part of each of them is a water-graphite reactor or, more precisely, a reactor unit producing saturated steam using a single-loop system. Steam from the drum of the separator is fed to a central heating turbine. Part of the steam leaving from the turbine is used to heat water supplied to the heating station in the village of Bilibino. The design of the nuclear reactor, which is based on the reactor of the first nuclear power plant in the city of Obninsk, embodies a number of new technical concepts that have raised the reliability and economy of the station. The reactor units of the ATETs can work with a variable output on a regular basis. This permits the plant to provide power during times of variable load in the power network. In this case the output of the reactors is either regulated by plant personnel on the basis of a dispatcher's schedule, or it is changed automatically by signals from the power network. On certain days the output of the power production units operating with a variable load changes by 50-100 percent 3 or 4 times a day. While the task of achieving such a work routine is only just starting to be addressed in nuclear power engineering, owing to the technical concepts employed, and chiefly in relation to the heat releasing elements, this problem has already been solved to a significant degree at the Bilibinskaya ATETs. [By Academician N. Dollezhal, twice-awarded Hero of Socialist Labor] [Excerpts] [Moscow PRAVDA in Russian 20 Sep 85 p 3] 11004

**REPAIRS ON SREDNEURALSKAYA GRES**--Sredneuralsk--The Sredneuralskaya Order of Lenin GRES is famous for the fact that it has established fuel economy records during power production each year for the last 10 years. It produces the cheapest kilowatt-hour in the sector. These record indicators are achieved owing to maximum utilization of output capacities, competent equipment operation and excellent preparations for work in winter. The plant has already completed over half of all of the planned work. Power production unit No 11 was overhauled 2 days ahead of schedule. Work on unit No 10 is nearing completion. This is an anniversary year for the collective of the Sredneuralskaya GRES. The plant is half a century old. The power engineers decided to mark this date by a new record--raising the coefficient of output capacity utilization to 0.95 while minimizing the amount of fuel consumed to produce every kilowatt-hour. In parallel with the repairs, the equipment of the veteran plant is undergoing renovation as well. A new type of heater has already been installed in unit No 11, which will raise the unit's efficiency by half a percent and result in a significant fuel savings. Of course, this is not at all the only innovation. The plant collective maintains regular contacts



with 16 scientific research organizations. Scientists have assisted in the introduction of electromagnetic condensate purification, and the most up-to-date methods of protecting the turbines from vibration are used. Have all of the reserves been utilized to raise the reliability and insure good operation in winter? S. Kozikov, chief of the power plant's repair service, believes that it would be entirely possible to triple the volume of repairs based on module replacement. But this work method, which is one of the most effective ones, is not being utilized fully because the sector has not yet organized efficient and complete supply of all of the materials and spare parts needed by the plants. [By correspondent A. Maltsev] [Excerpts] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Aug 85 p 1] 11004

ZAPOROZHSKAYA AES LINE PRODUCTION--A report titled "Reactors on Line" published 11 July described the experience of accelerated erection of the Zaporozhskaya Nuclear Power Plant at a high level of industrialization of construction; effective procedures were used at the construction site, and the practice of installing structures as enlarged units was introduced. In his reply to the editorial board, A. Gushchin, deputy chief of Soyuzatomenergostroy, reported that a decision was made to improve flow line construction and to introduce a quantitatively new stage--erection of the Zaporozhskaya and Chigirinskaya nuclear power plants on the basis of a single regional flow line. Reduction of the time it takes to build million kilowatt power production units by the flow line method and to place them in operation will make it possible to save 45.4 million tons of standard fuel units, to produce an additional 169 billion kilowatt-hours of electric power and achieve a national economic impact totaling 3.8 billion rubles at both nuclear power plants. Introduction of long-term schedules for delivering structural members from the plants and a significant increase in the degree of prefabrication of the structures are planned for the near future. All of this will make it possible to reduce labor outlays and achieve an economic impact totaling 130,000 rubles. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 5 Sep 85 p 2] 11004

IZHORA PRODUCES ROLLING MILL--Assembly of auxiliary equipment for a unique "5000" rolling mill has been completed at the Izhorskiy Zavod Production Association by subdivisions of the USSR Ministry of Installation and Special Construction Work. Rolled metal from Izhora is being awaited impatiently by the builders of nuclear power plants. Rolled metal 5 meters wide will be produced for the first time in the Soviet Union by the "5000" mill--one of the largest in the world. This will make it possible to minimize the number of welded seams on reactor shells, which will significantly raise reliability and improve the operating properties of nuclear power plants. [By N. Rybakov] [Text] [Moscow SOVETSKAYA ROSSIYA in Russian 10 Sep 85 p 1] 11004

PLEDGES REVIEWED--Penza--Workers and specialists of the Penztyazhpromarmatura Production Association announced their desire to honorably welcome the 27th CPSU Congress. New, more-challenging pledges were affirmed. It was decided in particular to significantly surpass the control figures of the five-year quota for product manufacture. Nuclear power plants and other highly important national economic facilities will receive more industrial pipeline fittings than planned--13.4 million rubles worth more. Plans have been made to raise labor productivity further. It will exceed the planned level by a factor of 1.7. The collectives of four sections and 26 brigades and almost 450 workers

competing on an individual basis also pledged to fulfill the plans for the first 2 months of 1986 by the opening of the congress. [By correspondent V. Lifanov] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 8 Aug 85 p 1] 11004

YASLOVSKE-BOGUNITSE AES--Prague--The village of Yaslovske-Bogunitse, which was quite unknown until recently, has now become a center of power engineering. Czechoslovakia's largest nuclear power plant is operating here. "The nuclear power plant, which is equipped with Soviet-designed VVR-440 reactors, has demonstrated high reliability and effectiveness," said Vilyam Ziman, the plant's chief engineer. "Start-up of the third power production unit became yet another noteworthy stage in the development of Czech-Soviet cooperation." As is the case with other nuclear power plants in Czechoslovakia, that in Yaslovske-Bogunitse is being built on the basis of Soviet plans with the direct participation of Soviet specialists. Start-up of the third power production unit made it possible to significantly alleviate the consequences of the severe winter to the national economy. Installation of the fourth and last power production unit of the station was carried on simultaneously. On 2 August of this year it began producing power. The nuclear plant in Yaslovske-Bogunitse went into full operation. Czechoslovak and Soviet specialists have now focused their attention on another giant of nuclear power engineering in Czechoslovakia--the nuclear power plant in Dukovany. At the beginning of this year its first power production unit went into operation. It has already produced 1.2 billion kilowatt-hours of electric power for the national economy. The second power production unit will be started up next year. [By correspondent S. Vtorushin] [Excerpts] [Moscow PRAVDA in Russian 30 Sep 85 p 4] 11004

CZECH DUKOVANY AES--Prague, 21 [Sep], TASS--The collective of builders of the Dukovany Nuclear Power Plant made a great contribution to completing the major program for development of nuclear power engineering in Czechoslovakia. The first power production unit is now producing an industrial load at this nuclear power plant, which is being erected with the technical assistance of the Soviet Union. [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Sep 85 p 3] 11004

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## PIPELINE CONSTRUCTION

### DEPUTY MINISTER ON ECOLOGICAL IMPACT OF PIPELINE CONSTRUCTION

Moscow SELSKAYA ZHIZN in Russian 4 Oct 85 p 1

[Interview with Gennadiy Iosifovich Shmal, First Deputy Minister of Construction of Petroleum and Gas Industry Enterprises, by B. Lvov, entitled "In the Region of Gas Trunk lines"; date and place not specified]

[Text] Each year the length of trunk pipelines in our country increases by 12-15,000 kilometers. This form of transport, an integral part of the fuel-energy industry, is being developed at a rapid rate. This tendency will continue in the 12th Five-Year Plan. As noted, however, at a meeting of party economists from Tyumen and Tomsk oblasts, it is necessary to consider not only short-term profit but the preservation of the wealth and beauty of the earth for future generations.

It is common knowledge that pipelines are laid not only in the Arctic but also in areas of intense cultivation, heavy forestry activity, and interregional watersheds. And the presence of construction workers, of course, affects the surrounding environment. The route being laid also has an effect on agro-industrial complexes and on the conservation and productivity of land. How to prevent negative impact on the earth, the environment! The conversation with the First Deputy Minister of the Construction of Petroleum and Gas Industry Enterprises, G. I. Shmal, is about this.

[Question] Construction workers, accomplishing so much impressive work involving large areas of the earth, it seems, should undertake environmental protection measures. One must not create on the one hand and destroy on the other.

[Answer] You're right. Before talking about what the builders do, I will give an example. Each long trunk line for about one quarter of its length crosses fields, meadows, and other valuable agricultural land. Thus the Urengoi-Pomary-Uzhgorod international transcontinental gas pipeline runs more than a thousand kilometers through the rich grain-producing areas of Russia and the Ukraine. The trench itself where the pipe is laid, in areas

along the line, has a general width of 45 meters. All of this strip, extending many kilometers, is subject to reclamation. By mandatory order! The land reclamation plan is developed in accordance with the USSR Fundamentals of Land Legislation. Included in this are the basic positions on the reclamation of land disturbed during the exploitation of fossil fuel deposits, exploration, construction, or other work.

According to the land user's requirements reclamation is performed on arable land, meadows, and pasture. The depth of topsoil layer to be reclaimed, depending on the locality of the pipeline, is determined by technical conditions and is from .2 to .5 meters.

This is only one route. There are a lot of them being built. Thus new large tracts of field, forest, and pasture are temporarily used by construction workers. The land ought to be restored, as the phrase is, to its original condition, in full ecological balance. Here is why construction organizations have formed special units for land reclamation. Each year they return to the land users up to ten thousand hectares.

In connection with this I want to recall the results of land reclamation done by Soviet builders in Hungary during the laying of the gas pipeline from the Soviet border to Budapest.

The following instance indicates how they carried out their work. On one of the cooperative fields which the route crossed, a tractor knocked down one of the special indicators, markers, warning that the pipeline is located here. The inspectors of the operation and status of the trunk line almost had to resort to a metal detector to determine the location of the gas artery under the field.

[Question] A fine example. Evidently such high quality reclamation is most closely connected with the conservation experience accumulated by the trunk line workers. It would be interesting to hear about that.

[Answer] A lot of experience was gained. And we are wholly and fully indebted to the special service for conservation and efficient use and renewing of natural resources. It was organized in conjunction with a special government decree that obligated planning and construction organizations creating new facilities to pay particular attention to measures preventing pollution and degradation of the environment.

Responsibility for this starts with the first steps in the creation of oil and gas facilities and equally affects pipeline construction. That is why the basic tasks of this service is the organization of work for protecting the environment from industrial waste pollution by means of implementing less wasteful or non-wasteful technological processes, effective means of cleaning waste water, and timely reclamation of land.

[Question] Pipeline routes in a number of places cross forests and water barriers, related to many components of the biosphere. Would you address this?

[Answer] I will touch upon forest tracts first of all. Since the points of origin of trunk line construction are mainly in western Siberia, rich in forests, making clearings is naturally one of the first tasks for the construction workers. After all about half the length of the routes are in forested areas. In order to lay them, to make clearings, each year it is necessary to clear more than 10,000 hectares of forest.

Here there are, frankly speaking, problems which as yet are not completely solved. If in the European part two million cubic meters of commercial timber are salvaged in making clearings, then in western Siberia, where the talga is frequently comprised of small-dimension timber, the situation is worse.

We are waiting to hear from Minlesbumprom (Ministry of Timber, Pulp and Paper, and Wood Processing Industry). Intensive pipeline construction work has occurred for many years, with the volume of felling during clearing increasing each year. Up to now, however, acceptable methods of salvaging slash have not been found. No new forestry technology has been introduced for small-dimension tracts.

Also awaiting a solution is the purification of water used for hydraulic testing of welded pipe. Its source is usually rivers which the route cuts across. The amount of water diverted from them is rather large. It is estimated that testing even one pipeline 1,000 kilometers long and one and a half meters in diameter requires one and a half million cubic meters of water. But the problem isn't this, of course, but that the water returning to the river from within the pipeline might be polluted by various contaminants. We must be critical of ourselves, in that we have done so little to develop a mobile field unit for cleaning this used water.

[Question] Evidently problems in developing mobile equipment and efficient working procedure are critical in environmental protection at trunk line sites, and for preservation of ecological balance as well?

[Answer] Of course. We have reclaimed land everywhere with the use of large bulldozers. This led to the loss of the fertile layer of soil. Moreover the daily rate of reclamation was not high--about half a kilometer of right-of-way.

From a proposal of a division of the All-Union Institute for Trunk Pipeline Construction a new technology has been developed. It excludes the use of bulldozers. Instead rotary excavators were used along with additional equipment. The loss of topsoil was significantly decreased, the amount of biological reclamation was reduced by almost two thirds and was higher in quality. The rate of work increased to three kilometers a day.

There are still quite a number of problems whose solutions remain to be worked on. Thus reclamation experience suggests that while the topsoil in fields crossed by a route is practically fully restored, there is frequently some loss of productivity in the first years after pipeline construction. Obviously, the efforts of several ministries and departments, mainly in

agriculture and agricultural science, will help us to fully ascertain and eliminate the cause.

The following problem also demands intensive study: The temperature of soil in the right-of-way which has been disturbed during pipeline construction and returned to land users is somewhat higher than the surrounding earth due to natural heat transfer from the product being pumped through the pipeline. Consequently the crops here ripen more quickly than on the remaining area. Complete conservation of this field would require separate harvesting. But again the pipeline's thermal regime and its associated dates for maturity of crops can be determined by the combined efforts of construction workers, operators, and land users.

Special attention should be paid to equipment, especially for use in the north.

This example shows how important are preserving the ecological balance and implementing environmental protection measures. The passage of an ordinary crawler tractor on the tundra causes progressive damage to the plant cover, disturbance to the landscape, and intensive bog formation.

Our duty to protect nature and to efficiently use and renew natural resources functions alongside and together with the duty toward quality. Such an approach prevents all possible flaws in planning routes and in constructing man-made structures which could cause gullying and landslides. The task of workers is to treat the earth very gently and carefully, to conduct their work so that it will always flourish and give its blessings to man.

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## PIPELINE CONSTRUCTION

### NEW APPROACHES TO PLANNING, MANAGING PIPELINE CONSTRUCTION

Moscow NA STROYKAKH ROSSII in Russian No 10, Oct 85 pp 11-15

[Article by A. Shchenkov, doctor of engineering sciences and director of VNIIEGazprom [All-Union Scientific-Research Institute for the Economics and Organization of Production, Technical and Economic Information for the Gas Industry] of USSR Mingazprom [USSR Ministry of Gas Industry] and V. Tolstolugov, candidate of engineering sciences and deputy director of GIVTs [Main Computing and Data-Processing Center] of Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises]: "The Integrated System for Current Planning and Control of Pipeline Construction"]

[Text] The construction of oil and gas facilities has been promoted dynamically during the 11th Five-Year Plan. At the start of 1985 all six of the planned gas trunk lines had been put into operation: the Urengoy-Gryazovets-MOK [Moscow District Gas Ring], Urengoy-Petrovsk, Urengoy-Novopskov, Urengoy-Pomary-Uzhgorod, Urengoy-Tsentr [Central Economic Region]-I and Urengoy-Tsentr-II. Erection of the Yamburg-Yelets gas trunk pipeline, which is above the plan, and assimilation of the Yamburg gas-condensate field, have started. Labor productivity has reached the level contemplated for the end of the five-year plan.

The branch has taken major measures to restructure organizational forms for pipeline construction, to improve the economic mechanism comprehensively, and to create an integrated automated system for current planning and control which will function at all stages of the investment cycle.

An important means for realizing the program for accelerating the erection of superpipelines was a large-scale experiment in organizing the construction of the gas arterials by subunits of a new type, which were specialized by stage of the production process: integrated flowline operations groups and mobile mechanized columns for road construction and transport operations and for engineering preparation of the section for the construction work. Execution of the program for interregional maneuverability of the flowline operating groups was also of great importance. New methods for planning and for material incentives for the production collectives, based upon brigade-contract principles, the Shchekino method, and other methods, were developed and introduced.

The conversion from specialization by type of work to specialization by stage of pipeline-construction operations process and measures for improving the economic mechanism promoted a consistent growth in labor productivity and rise in construction-operating effectiveness and final-product quality.

An analysis of the experience gained indicates that the problem of developing and introducing new, dynamically restructured organizational structures and intensive technologies, both directly in construction operations and in the sphere of the design of organization and operations and of current planning and control, has now been shifted, in the drive for a further intensification and a rise in the efficiency and quality of oil and gas construction, to first priority. In so doing, questions of reequipping, rebuilding and modernizing construction work should be kept in mind constantly. It is precisely this integrated and comprehensive approach to the problem that will allow high-quality transformation of the branch's production forces to be accomplished. This entails a constant search for new and more efficient ways of organizing for improving the management mechanism and dynamically restructuring the existing system for current planning and control.

Much has been done in this area during the 11th Five-Year Plan, primarily the creation of the technical and operating bases for establishing a ramified computations and data-processing network (IVS) for the branch. Minneftegazstroy has now developed, altogether, six computations and data-processing centers--at Moscow, Tyumen, Ukhta, Almet'yevsk, Kiev and Rostov-on-the-Don and two GIVTs base sections--at Ufa and Ashkhabad. A YeS [Unified Electronic Computer System] type computer, an Iskra-226 type minicomputer, and a YeS-8534 type intelligent terminal make up the equipment base for the IVS. Automated data processing covers an average of 18 percent of all production organizations, beginning with the trust level, using TAP-2, TAP-3 and YeS-8534 type data-transmitting equipment. The existing structure of the branch's IVS's and one of the possible variants for its development is shown in figure 1.

The operating base for the branch's computations and data-processing network is made up of automated sets of tasks that are developed in accordance with the specific-purpose integrated science-and-production program of Minneftegazstroy for improving the branch's system for current planning and control, with the involvement of the AN UkrSSR [Ukrainian SSR Academy of Sciences] Cybenetics Institute, TsMIPKS [Central Interagency Institute for Raising the Qualifications of Supervisory Construction Workers and Specialists] under MISI [Moscow Construction-Engineering Institute] imeni V. V. Kuybyshev, BelNIOUS [Belorussian Scientific-Research Institute for the Organization and Control of Construction], BGU [Belorussian State University imeni V. I. Lenin] and other organizations. The directions and the volume of operations for the branch's satellite computations and data-processing centers and for VNIIST [All-Union Scientific-Research Institute for Trunk Pipeline Construction] and its Kiev branch and NIPIorgneftegazstroy [Scientific-Research and Design Institute of the State Trust for Industrializing the Construction of Oil and Gas Industry Enterprises] were set within the framework of this program. Minneftegazstroy's GIVTs monitored and coordinated execution of the specific tasks.

The concept of integration, that is, an organic system for correlating the control organs of the different levels and different missions, both along



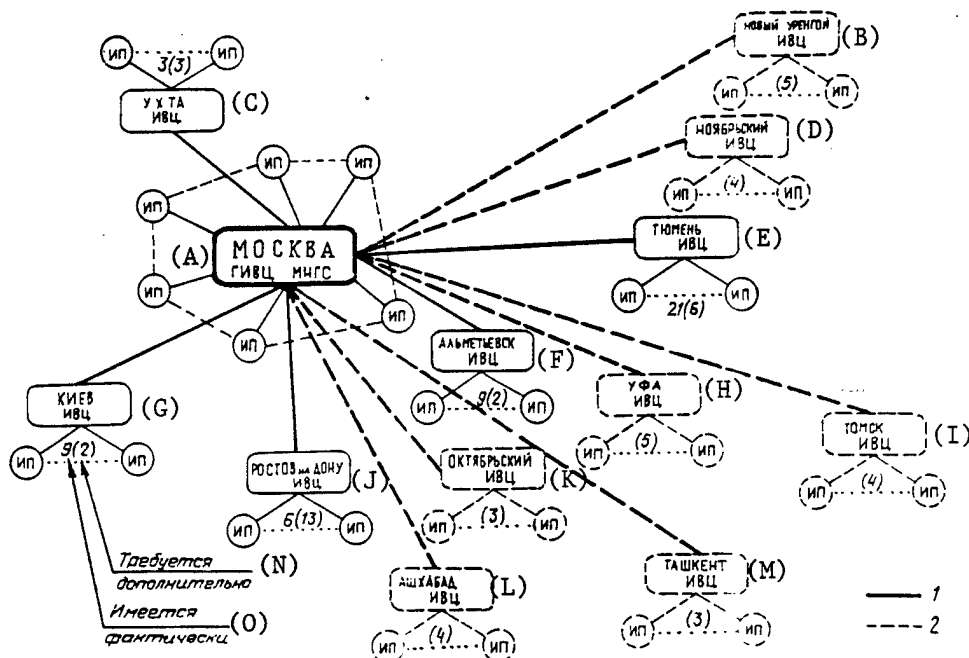


Figure 1. Diagram of Development of the Branch's Information and Computations Network (the Existing Situation and One of the Possible Variants of Its Development Proposed by the Authors).

ГИВЦ Main Information and Computations Center.

ИП Data point equipped with a YeS-8534.

1. In existence.
2. Prospective development.

- A. Moscow GIVTs of MNGS [Ministry of Construction of Petroleum and Gas Industry Enterprises].
- B. Novyy Urengoy IVTs [Information and Computations Center].
- C. Ukhta Information and Computations Center.
- D. Noyabrskiy Information and Computations Center.
- E. Tyumen Information and Computations Center.
- F. Almet'yevsk Information and Computations Center.
- G. Kiev Information and Computations Center.
- H. Ufa Information and Computations Center.
- I. Tomsk Information and Computations Center.
- J. Rostov-on-the-Don Information and Computations Center.
- K. Oktyabrskiy Information and Computations Center.
- L. Ashkhabad Information and Computations Center.
- M. Tashkent Information and Computations Center.
- N. Additional required.
- O. In existence.

the vertical (from specialized brigades and columns to the ministry's central staff) and along the horizontal, at each level, with output based on local, regional and interagency communications, was made the basis for the special-purpose program. A most important aspect of integration--by construction-process stage (organizational, preparatory, basic and completion processes)--should be pointed out once again.

The purposeful concentration of the resources of scientific workers, designers and programmers in the strategically important areas has allowed a complex of instrumented means that are oriented practically to every user, beginning with the SU [construction administration] (or SMU [construction and installing administration]) and PMK [mobile mechanized column] and ending with the ministry's central staff, and are tied together systemically, to be developed and introduced within a comparatively short time.

Standard operating complexes of data-programing means that are based upon mini- and microprocessor equipment, namely: an interactive simulation system for multivariate organizational and operational design, forecasting and current control of pipeline construction (DISPUT-S); a system for specialized simulation models for the functioning of a pipeline-construction complex (SIM TSK); an interactive information-analyzing system for oil and gas pipeline construction (DIAS); and an interactive system for the collection and processing of daily information about progress in construction of the most important line jobs of Minneftegazstroy (LINIYA), have been developed and are being introduced gradually. A system of specialized simulation models for outfitted-module construction (SIM KBS) for compressor and gas-repumping stations is in the development stage.

The interactive simulation system DISPUT-S (figure 2) has been realized on the basis of the minicomputer as standard technology and has been oriented to Orgtekhstroy [State Trust for the Industrialization of Construction Work] system designers and for workers of production-management sections and administrations, trusts, main production administrations and the ministry's central staff.

It enables the decisionmaker to work with one pipeline-construction complex or with any set of them for the construction of one or of several line facilities of various diameters and purposes. In so doing, the person or group of persons who make the decisions can vary 11 parameters in any combination, such as: dates of start and completion of the work, boundaries of the construction section, direction of movement of the flowline operating group, redeployments, and so on.

The DISPUT-S system is intended for solving sets of tasks for the organizational, preparatory, basic-operation and completion stages, within the bounds of regular and situational control. As a result of solving the tasks, the work volume is distributed among subunits, the bounds of the construction section and the forecast dates for completion of the work are determined, critical flowline operating groups are identified, schedules for the performance of the operations are compiled, with breakdown by week and day, and so on.

In order to solve these tasks, the method of adaptive statistical approximation is used. It is based upon statistical information about results of the work done by the various flowline groups in each natural and climatic zone while erecting pipelines of a single diameter over several years. Reporting, analysis, forecasting and decisionmaking are accomplished in accordance with the indicator for the final product--the amount of work on insulating and laying pipe, in kilometers.

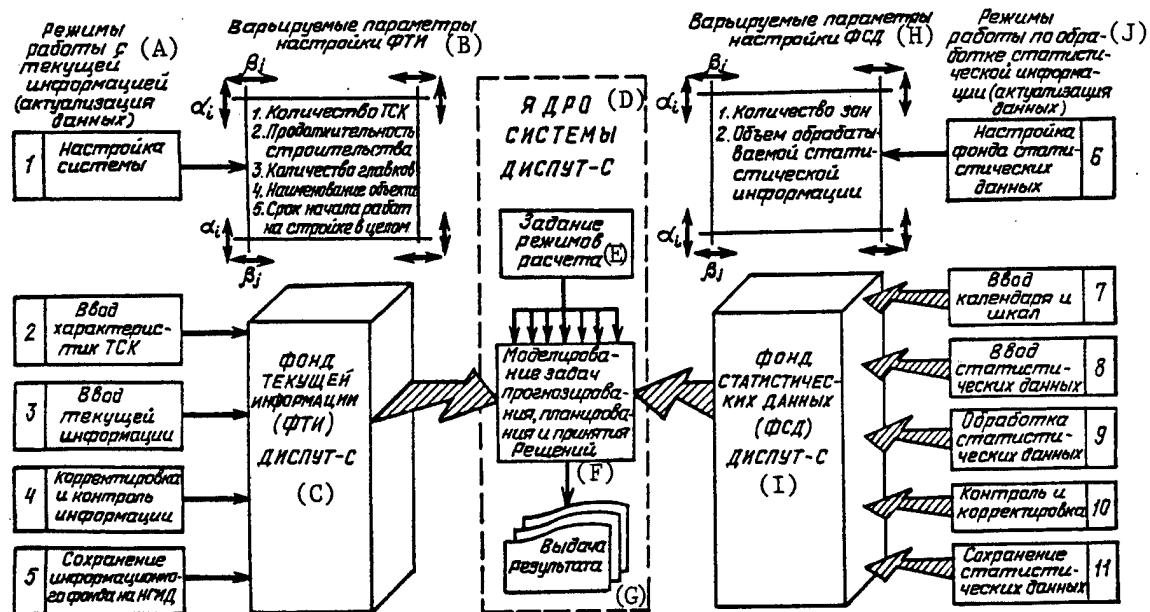


Figure 2. Functional and Informational Structure of the Interactive Simulation System for Multivariate Organizational and Operational Design, Forecasting and Adoption of Decisions DISPUT-S [Interactive Simulation System for Multivariate Organizational and Operational Design, Forecasting and Current Control of Pipeline Construction].

- A. Modes for operation with current information (application of the data).
1. Setting the system.
  2. Introduction of TSK [pipeline-construction complex] characteristics.
  3. Introduction of current information.
  4. Revision and monitoring of information.
  5. Storage of information file on NGMD [not further identified].
- B. Variable parameters for setting the FTI (current information file).
1. Number of TSK's.
  2. Duration of construction.
  3. Number of main administrations.
  4. Designation of the facility.
  5. Date of start of work on the project as a whole.
- C. Current information file (FTI) of DISPUT-S.
- D. Nucleus of the DISPUT-S System.
- E. Task of computations modes.
- F. Simulation of tasks of forecasting, planning and adopting decisions.
- G. Issuance of results.

[Key continued on next page]

[Figure 2--continuation of key]

- H. Variable parameters for setting FSD [statistical information file].
    - 1. Number of zones.
    - 2. Volume of statistical data processable.
  - I. Statistical data file (FSD) of DISPUT-S.
  - J. Operating modes for processing statistical information (application of the data).
    - 6. Setting the statistical information file.
    - 7. Introduction of the calendar and scale.
    - 8. Introduction of statistical data.
    - 9. Processing of the statistical data.
    - 10. Monitoring and revision.
    - 11. Storage of statistical data.
- 

Other features of the construction conditions are aggregated in the form of scales of the dependence of the work intensity upon the type of zones and the period and stages of construction. Moreover, dynamic evaluations are used for the current production potential of each pipeline construction complex, based upon the given or the preceding construction job.

The dynamic system for multivariate organizational and operational planning, forecasting and decisionmaking was realized for the first time during construction of the Urengoy-Pomary-Uzhgorod export gas trunk pipeline. The specific schedule prescribed by higher authority for construction of the gas pipeline's linear portion was developed with use of the interactive DISPUT-S system, monthly schedules for performing the work were figured out, weekly and daily tasks for the pipeline-construction complexes were established, and organizational and operational measures for insuring fulfillment of the prescribed schedule were determined. The aggregate economic benefit from introducing the system was more than 1.7 million rubles.

At present, the system for multivariate organizational and operational planning, forecasting and current control has been put into practice in the work of the main production-management administration and also in such organizations as Glavtruboprovodstroy [Main Administration for Pipeline Construction], Glavvostoktruboprovodstroy [Main Administration for Pipeline Construction in the Eastern Regions] and Glavyuzhtruboprovodstroy [Main Administration for Pipeline Construction in the Southern Regions].

The SIM TSK's sphere of use is the conduct of calendar plan calculations, the analysis and selection of schedules for performing line-type operations and the options analysis of the status of resources of specialized flowline operating groups. The nucleus of the SIM TSK is a probabilistic simulation of the functioning of the primary productive collective. Effective operation of the simulation model is maintained by a constantly updated base, which contains all the necessary characteristics of the construction flowline groups and of the facility being erected, and a library of service routines. Unlike the DISPUT-S system, the SIM TSK considers the peculiarities of traversing the pipeline route, forecast data about the weather,

and mutually replaceable variants in the provisioning of resources. The system includes 15 types of operations for which schedules are developed, and the operating sequence for executing them is described, taking into account possible anticipatory work in advance. Expansion of the system is permitted.

The use of minicomputers for solving tasks of a data-retrieval and an analytical nature have opened up great possibilities. They enable straightforward selections, groupings, collations and a confluence of informational elements to be realized, with issuance of the corresponding lists, tables and reports within the framework of the interactive information-analysis system (DIAS), which is used for solving informational, retrieval, directory and analytical tasks within the system for planning and controlling construction of the most important gas trunk pipelines.

The basic specific mission of DIAS is to provide a broad range of nonprogram users with instrumented means for designing forms for information input and output and for constructing algorithms for computation of variables of the indicators, with aggregation of the information in accordance with the level of the control system.

The system is simple in operation. Its use for solving tasks of current monitoring, analysis and control of trunk-pipeline construction changes qualitatively the nature of the job of management workers. One can also note such areas of DIAS use as the preparation of analytical data for teleconferences, the forming of monthly reports about progress in meeting the production programs of the main administration and the trust, and operation in the data-retrieval systems mode.

The LINIYa interactive system for collecting and processing information enables the introduction and storage of baseline data for seven parameters and covers monitoring of up to 300 sections. Output information can be delivered to the video-terminal screen and to a printer. The main receiving, transmitting and processing element of this system is the Hungarian-made YeS-8534 intelligent terminal.

The greatest systems benefit is achieved by the collective use of the interactive DISPUT-S, SIM TSK, DIAS and LINIYa equipment in order to realize data operating processes for multivariate organizational and operational design, forecasting, analysis and decisionmaking at all levels of branch control (figure 3).

A study of the processes that transpire in the branch control system allows strategic areas for further improving the design, organization and current control of oil and gas construction to be identified, namely:

- the development of a multilevel integrated system that provides for effective work by line personnel and functional subunits at all levels of control;
- further development of the branch's computations and data-processing network (IVS);

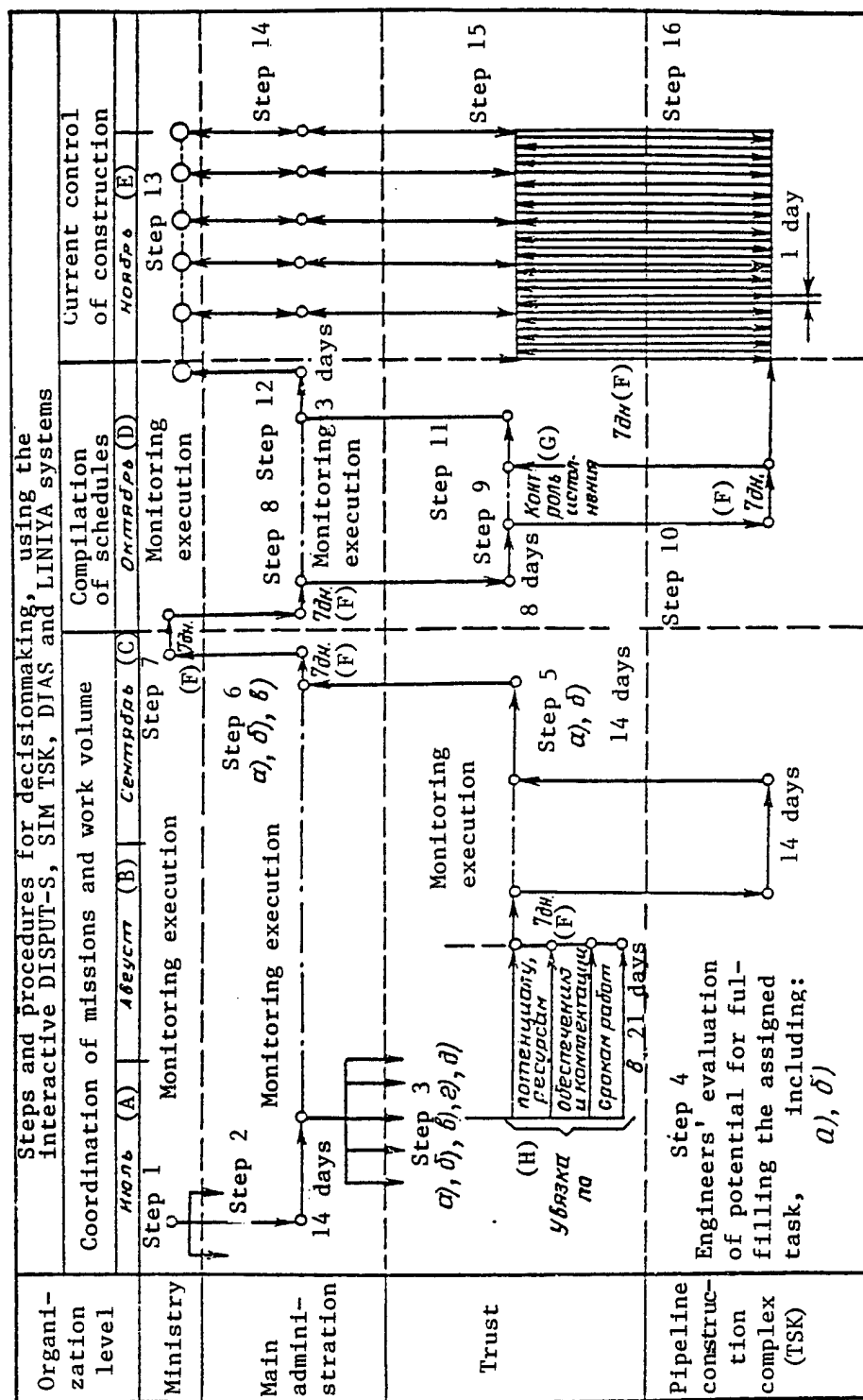


Figure 3. Steps and Procedures for Forecasting, Developing Production-Operations Schedules and Adopting Decisions, Using the Interactive DISPUT-S, SIM TSK, DIAS and LINIYA systems.

[Key on next page]

[Key to figure 3.]

DISPUT-S: Interactive Simulation System for Multivariate Organizational and Operational Design [and Current Control of Pipeline Construction].

SIM TSK: Specialized Simulation Model [of the Functioning] of a Pipeline Construction Complex.

DIAS: Interactive Informational Analytical System [for Oil and Gas Construction].

A. July. B. August. C. September. D. October. E. November.

F. 7 days. G. Monitoring execution.

H. Correlation on: 

|                          |
|--------------------------|
| Potential, resources     |
| Supplying and outfitting |
| Dates of operations      |

Step 1. Coordination of missions and amounts of work, by main administration.

Step 2. Coordination of missions and amounts of work, by trust.

Step 3. Engineers' evaluation of potential for fulfilling the tasks of all pipeline-construction complexes, with correlation as to:

a. Dates of completion of construction at facilities, for the current year.

δ. The production potential and production resources.

β. The supplying of materials and equipment and outfitting with complete sets.

γ. Dates of operation by general-contracting and subcontracting organizations.

δ. Determination of shortage (or loss) of capacity.

Step 4.

a. Computation of job schedule for performance of work by TSK's.

δ. The development of proposals on work volume and measures that will insure unconditional fulfillment by the assigned deadlines.

Step 5.

a. Development of proposals for revising work volumes.

δ. Development of measures for the trust which will insure unconditional fulfillment of operations by assigned deadlines for all TSK's.

Step 6.

a. Coordination of amounts of work by trust.

δ. The development of schedules for performing operations, for supplying materials and equipment, and for outfitting with complete sets.

β. The development of the plan for organizational and operational measures that will insure unconditional fulfillment of missions.

Step 7. The development and correlation of schedules for performance of operations, for supplying materials and equipment and for outfitting of the branch as a whole.

Steps 8 and 9. Development and confirmation of schedules for performing operations, for supplying materials and equipment, and for outfitting for the production program of the main administration and the trust.

Step 10. The development and adoption of counterplans.

[Key to figure 3, continued]

Step 11. The adoption of counterplans for the trust as a whole.

Step 12. The adoption of counterplans for the main administration as a whole.

Steps 13, 14, 15 and 16. The adoption of decisions in accordance with the situation, the coordination, regulation and monitoring of their execution, and the conducting of teleconferences.

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--the development of effective informational technology for the designing of organization and operations, and for accounting, monitoring, analysis, forecasting and decisionmaking at all levels of the investment cycle, and the creation of rational instrumented means for its realization; and

--improvement of organs of specific interagency, branch and regional control.

Development of the branch's computational and data-processing network is associated with the preparation of a basically new approach to the integration of existing local intrabranh and interbranch structures for computer equipment in the technologically related multimachine complexes which will provide for an active, dynamic man-machine dialog at any hierarchical level in the system for managing oil and gas construction.

Realization of the measures contemplated for improving the design for organization and operations, current planning and control of the construction of oil and gas enterprises will enable intrabranh reserves for the unconditional fulfillment of the national economy's tasks to be brought into action.

A technical and economic analysis of the functioning of interactive systems for the design of organization and operations, forecasting and current planning and control of oil and gas construction that have been put into practice has indicated their high effectiveness.

Comprehensive introduction of the new information technology, using the interactive DISPUT-S, SIM TSK, DIAS and LINIYa systems, has enabled the management personnel of the ministry's trusts, main production administrations and central staff to be provided with current, complete and reliable information, has helped to raise the effectiveness and quality of management decisions and to reduce the time for developing, adopting and realizing them, has raised the quality and reliability of current planning, and has provided for the development of production-work schedules that are balanced with the dynamic potential of the pipeline construction complexes. The confirmed economic benefit from realizing them is several million rubles.

Interactive instrumented means have been developed as standard informational and operational modules (ITM's) which can be used effectively at various levels of control, both by the Minneftegazstroy system and by the Ministry of Transport Construction, Minpromstroy [Ministry of Industrial Construction], Mintyazhstroy [Ministry of Construction of Heavy Industry Enterprises] and other branches of construction operations.

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ENERGY CONSERVATION

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USERS OF ELECTRIC ENERGY TO BECOME LOAD REGULATORS IN POWER SYSTEMS

Moscow TEPLOENERGETIKA in Russian No 12, Dec 85 pp 45-49

[Article by Yu. M. Kogan, doctor of economic sciences, Institute of Power Engineering imeni G. M. Krzhizhanovskiy]

[Abstract] Improving the maneuverability of power grids in the European part of the USSR by conventional means such a load dumping and partial shutdown or transfer of excess power at night time to eastern regions in the day zones has reached the level of diminishing returns, the penalty being a lower reliability and a drop in economic indicators. New means must be devised, therefore, especially in anticipation of further development of nuclear power generation. The main problem, namely equalization of the load curve, can be solved in two concurrent ways. One way is construction of special fossil-fuel power plants for coverage of peak and semipeak loads with atomic electric and hydroelectric power plants operating continuously to cover the base load. The other way is organization of energy users so that they become the load regulators. Establishment of such a user-regulator system is a process which involves two stages. The first and most difficult stage entails lowering the peak loads, shifting the excess loads, and coordinating the operation of atomic electric and hydroelectric power plants with the demand for energy in summer and in winter during day hours and during night hours. There is associated with it the problem of time and expense. A technical and economic feasibility analysis of such a system, covering all categories of users and all forms of energy available to them, indicates a need for revising the rate structure so as to include incentives such as lower night rates which will stimulate the necessary changes in energy consumption patterns. The next stage of developing a user-regulator system will involve innovations. Most promising here appear to be installation of heat storage devices in atomic electric power plants and introduction of the electric automobile as a new category of energy user on a massive scale. Figures 2; tables 2; references 7: all Russian.

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